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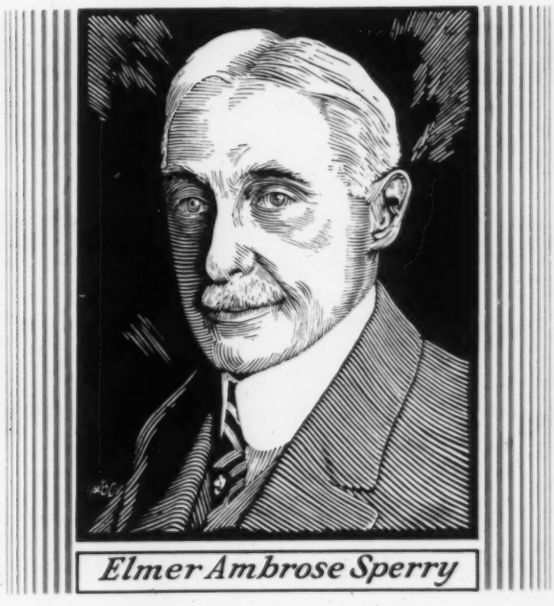
MACHINE DESIGN



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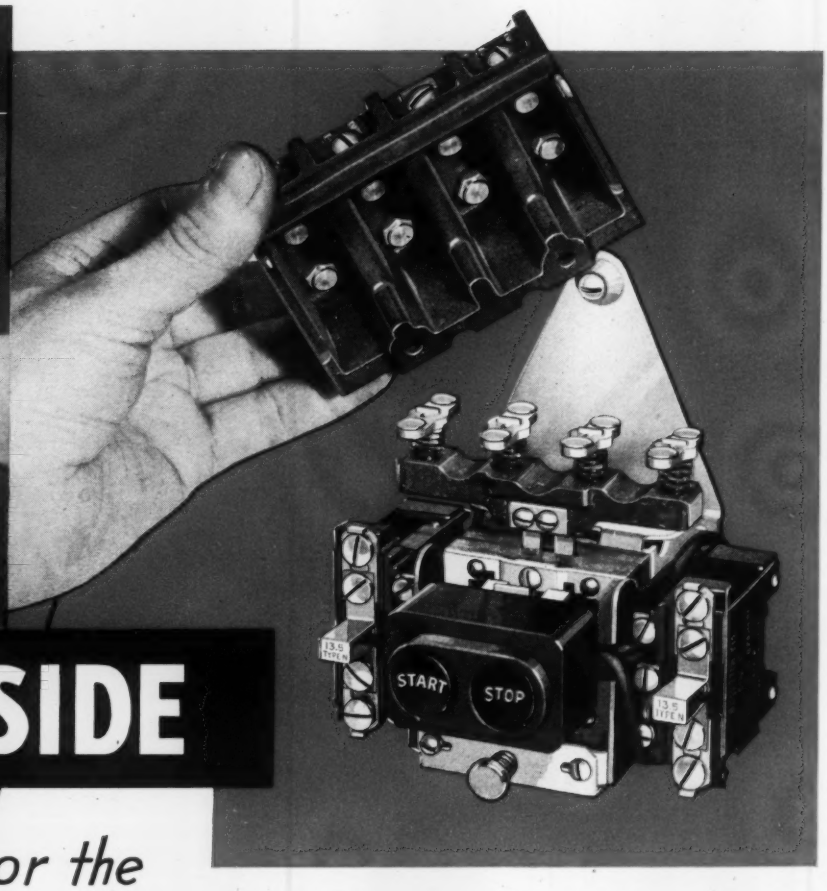

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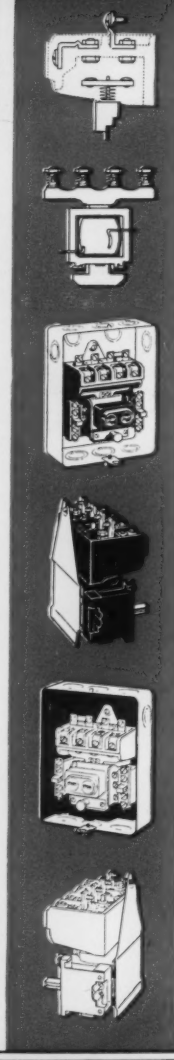

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MACHINE DESIGN

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VOLUME VI JANUARY 1934 NUMBER 1

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Branch Offices: New York, 220 Broadway; telephone Cortland 7-4594. Chicago, 1118 Peoples Gas Bldg.; telephone, Harrison 7506. London The Penton Publishing Co. Ltd., 416 Caxton House, Westminster, S. W. 1.

Machine Design is published on the tenth of each month. Subscription rates: United States and possessions, Cuba and Mexico, two years $5; one year $3. Single copies, 35 cents. Canada, two years $6; one year $3.50, including duty. Great Britain and other European countries, two years, £1.13.6; one year £1.0.0. Copyright, 1934 by The Johnson Publishing Co.

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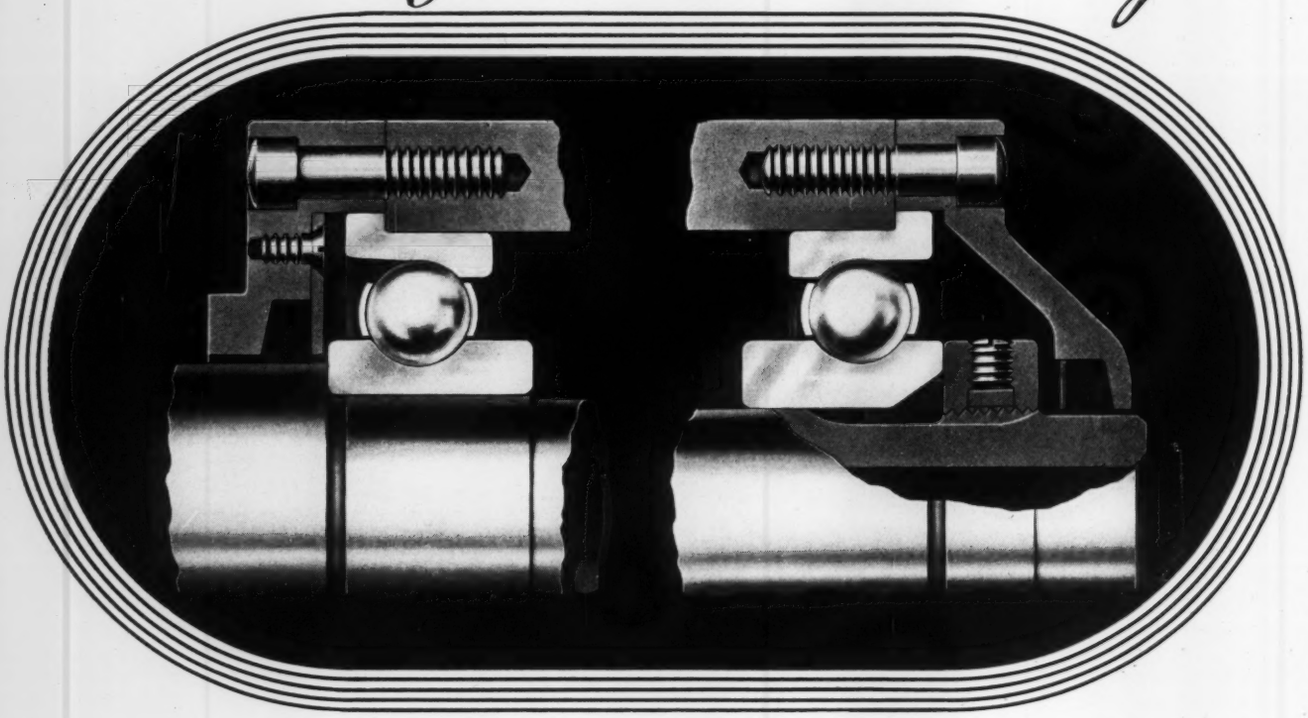

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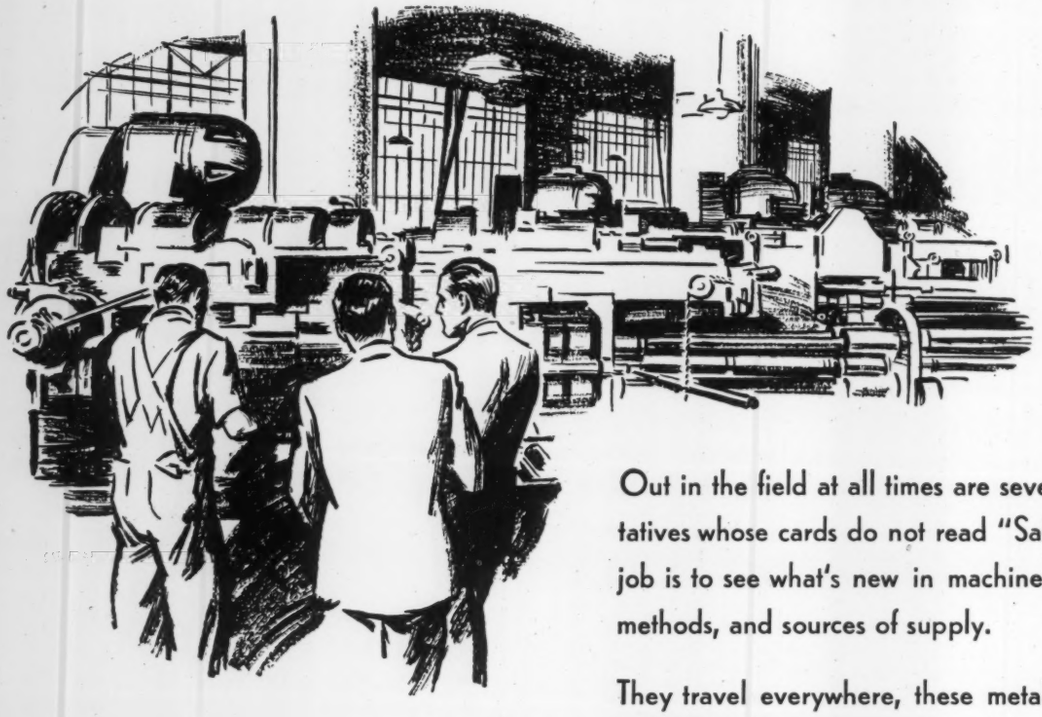

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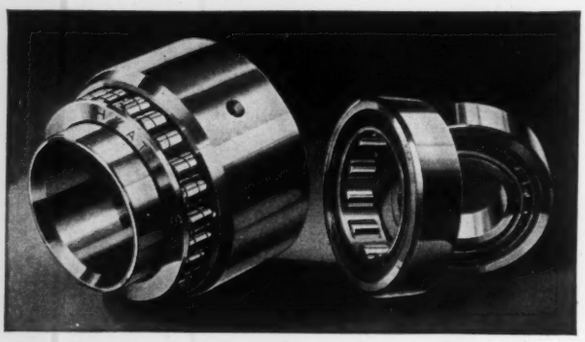

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CALENDAR OF MEETINGS AND EXPOSITIONS

Jan. 15-19—

Canning and Machinery Supplies association.

Annual exhibition to be held at Chicago will include displays of canning and packaging machinery. Information on the exposition may be secured from the association at 533 West Randolph street, Chicago.

Jan. 19-27—

National Power Boat Show.

Annual exhibition of power boats, engines, parts and accessories to be held at Grand Central Palace, New York. Information on the show may be obtained from National Association of Boat and Engine Manufacturers, Graybar building, New York.

Jan. 22-25—

Society of Automotive Engineers.

Annual meeting which will include a program of technical papers to be held at Book-Cadillac hotel, Detroit. John A. C. Warner, 29 West Thirty-ninth street, New York, is general manager of the automotive society.

Jan. 22-25—

American Road Builders' association.

Annual meeting and exposition of road machinery, tractors, parts and materials to be held at Stevens hotel, Chicago. Charles M. Upham, National Press building, Washington, is secretary of the association.

Jan. 23-26—

American Institute of Electrical Engineers.

Annual meeting to be held at Engineering Societies building, New York. H. H. Henline, 33 West Thirty-ninth street, New York, is secretary of the institute.

Feb. 5-9—

International Heating and Ventilating Exposition.

Third annual exhibition to be held at Grand Central Palace, New York, will include exhibits of units for heating, ventilating and air conditioning, materials, automatic switches and controls, thermostats, valves, burners designed to operate with gas, oil, solid fuels and electricity, fans, air filters, humidifiers, and similar apparatus and parts. Charles F. Roth, Grand Central Palace, New York, is manager of the exposition.

Feb. 5-8—

American Society of Heating and Ventilating Engineers.

Annual meeting to be held at Hotel Biltmore, New York. A. V. Hutchinson, 51 Madison avenue, New York, is secretary of the society.

Feb. 19—

Technical Association of the Pulp and Paper Industry.

Annual meeting and exposition to be held at Waldorf Astoria hotel, New York. R. C. Macdonald, 370 Lexington avenue, New York, is secretary of the association.

March 5-9—

American Oil Burner association.

Eleventh national oil burner show to be held at Commercial Museum, Philadelphia, will include operating exhibits. Annual meeting of the association to be held at Benjamin Franklin hotel, Philadelphia. Harry F. Tapp, 342 Madison avenue, New York, is secretary of the association.

March 13-16—

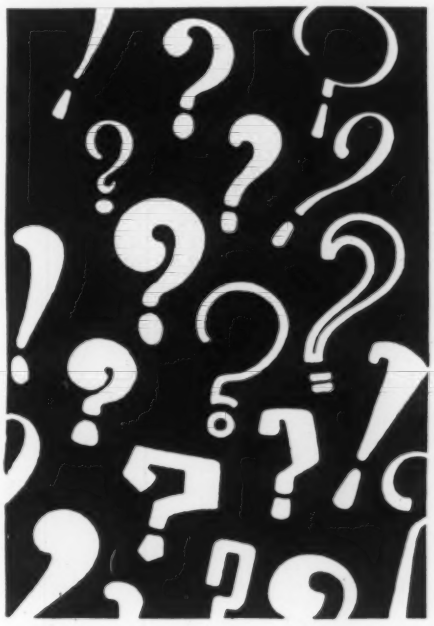
Fourth Packaging, Packing and Shipping Exposition.

Annual display of equipment for modern packaging, packing and shipping to be held under the auspices of American Management association at Hotel Astor, New York, will include exhibits of materials, packaging equipment, machinery and supplies including bottle filling, gum taping, wire stitching and sealing machines, also packing and shipping room accessories, transportation and delivery essentials. John G. Goetz, 20 Vesey street, New York, is managing director of the management association.

March 26-30—

American Chemical society.

Semiannual meeting at St. Petersburg, Fla. Dr. Charles L. Parsons, 728 Mills building, Washington, is secretary of the society.



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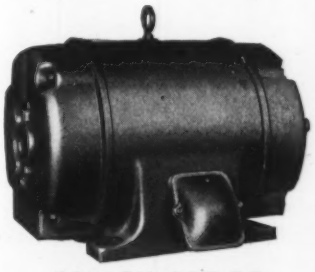

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MACHINE DESIGN
THE JOHNSON PUBLISHING CO., CLEVELAND, OHIO
January, 1934 Vol. 6—No. 1

Auto Designs Signify Trend Away from Traditional

By Austin M. Wolf
Automotive Consulting Engineer, New York

IN THE automotive field many new and attractive design features based on sound engineering and research are being presented. The breaking away of this field from stereotyped design is typical of present day endeavor wherein the accomplished results justify what would have been considered a bold departure a few years ago. The importance of automotive designs and trends cannot be minimized, as it is this field, closely in touch with the desires of the consumers, that sets the pace during the year.

Many conventional practices have been discarded and 1934 will be noted as the breaking point of traditional design. These efforts are not in view of making a change by itself but in order to effect a marked improvement in operation, comfort and economy. Beauty is not absent since it is an inherent corollary of worthwhile conception.

In the new cars the outstanding development is individual wheel suspension which supplements the front axle. Stiff front springs, with a small range of action limited by requirements of proper steering geometry, have heretofore produced discomfort. The chief virtue of individual mounting is the ability to give the wheels a freedom of action ranging about 4 inches each side of

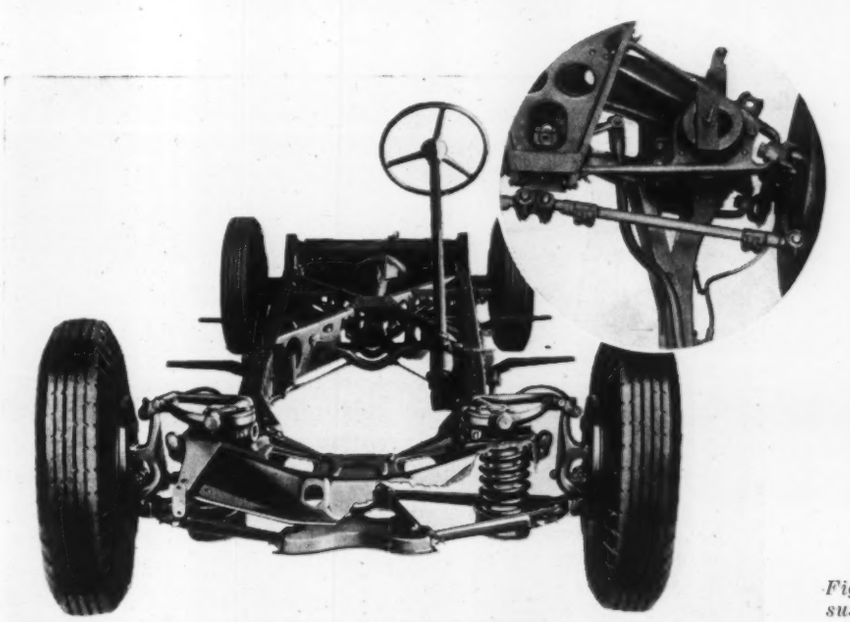


Fig. 1—In parallelogram-link type of spring suspension a pair of drop-forged arms are mounted on the frame

normal. Lack of a rigid member between the wheels prevents the telegraphing of vibration and shock from one side to the other.

The parallelogram-link type of construction is being used by Buick, Cadillac, Dodge, Oldsmobile and Plymouth. In this design a pair of drop-forged forked arms are fixed to the frame as shown in Fig. 1, the Buick construction. It will be noted that the lower member is longer than the upper, enabling the maintenance of a constant tread unaffected by the rise and fall of the wheels, thus preventing scuffing of the tires. The upper arm is anchored to a double acting shock absorber while the lower arm receives the coil spring on a stamped seat which also reinforces the arm.

Outer ends of the arms are secured to the steering knuckle forging by means of a forged connection which, with the frame pivots of the lower arm, are of the threaded spring bolt type. The upper end of the helical spring nests under the cross member and in an offset portion of the side rail. A rubber bumper within the spring provides a gradual snubbing action over the upper limit of travel. Downward limitation is taken care of by a rubber bumper on the outside of the frame contacting with the upper arm.

Helical springs were used in vehicles to a limited extent years ago, but with modern manufacturing methods and materials their more general reapplication is made possible. The helical spring is frictionless; for the same stiffness it is about one-half the weight of an equivalent

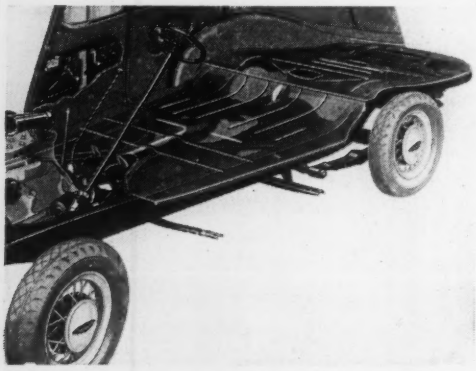


Fig. 2—Welded design provides a unit construction of the frame

leaf spring; due to the leverage on the spring in the parallelogram-link construction the effective rate is about one-quarter its actual rate, making a further fifty per cent weight reduction possible. Silico-manganese steel of a .55 carbon is being used by Cadillac.

Ideal steering results from the complete isolation of the springs from any function other than sustaining the load. It will be noted in

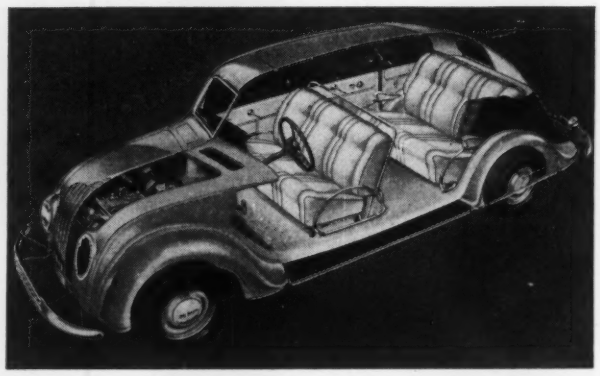


Fig. 3—By moving the engine ahead the moment of inertia of the vehicle is increased

the inset in Fig. 1 that the axes of the forked arms intersect at a point back of the front cross member. Individual drag links, anchored at their inner ends to a bellcrank in such a manner that the ball centers are close to these axes, extend to each wheel.

A different type of suspension utilizing helical springs is employed by Chevrolet and Pontiac. This is based on the Dubonnet principle disclosed in MACHINE DESIGN of April, 1933, but is of considerably revised form. Two arms are used to actuate the plunger type shock absorber, Fig. 4, and a single arm transfers the wheel load to the dual spring, the inner portion of which is only active over the limiting compression range. Slight axial movement of the spring unit is permitted by the spherical head at the fixed thrust end. The wheel, mounting arm and housing oscillate together about the king pin as the car is steered. All steering members are frame mounted and therefore are unaffected by wheel movement. The radius rod shown at the bottom of Fig. 4 holds the loosely mounted brake backing plate in position to maintain a constant geometrical relation between the frame and the brake mechanism.

Axles Are Interchangeable

Still another type of suspension, optional equipment on Hudson, Terraplane, Nash and Lafayette, is disclosed in Fig. 6 where it will be noted that conventional leaf springs are used. The axle interchanges with the rigid type and the shock absorber application is identical for both types. Drop-forged I-beam section rods with forked ends unite the axle ends in parallelogram fashion, the joints being of the needle bearing type. In common with the link type of suspension, the wheels incline outwardly at the top in making a turn and the body and frame in this construction are automatically banked as is disclosed in lower portion of the drawing. It will be evident that the torsional rigidity of the springs opposes the tilting of the axle ends.

The second major development in the new cars is the introduction of truly streamlined bodies, the result of considerable wind tunnel testing, as exemplified by DeSoto and Chrysler. The elimination of the usual radiator and hood and the substitution of a round-nosed front is the most apparent modification from the conventional. The engine has been moved forward 20 inches and the rear seat a like amount in order to place the passengers between the axles as disclosed in Fig. 3 which represents the DeSoto construction. In moving the engine ahead, the moment of inertia of the vehicle is increased and pitching due to a front wheel striking an obstruction is reduced.

Air is admitted through the grille front to the

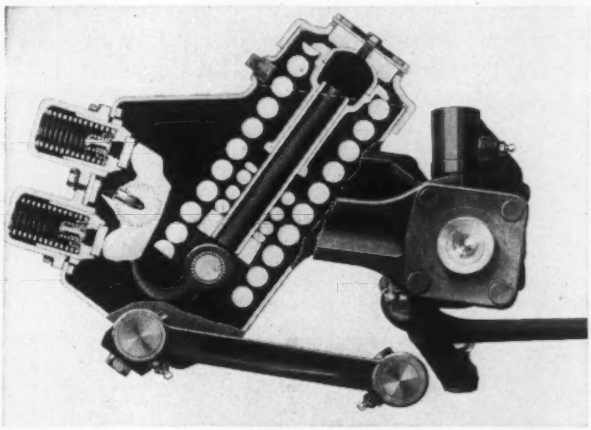


Fig. 4—Two arms are used to actuate the plunger type shock absorber recently introduced

radiator core behind which is the cooling fan mounted directly upon the engine crankshaft. The V-belt now drives only the generator and water pump. With streamlining of this type it is possible to lower the front windows without experiencing a draft.

A number of methods have been introduced to ventilate the interior of the car more thoroughly and to prevent drafts. In the Ford and Lincoln, an extra turn of the regulator handle causes the glass to move horizontally subsequent to the raising operation. The vertical opening thus provided allows air to be drawn out by the forward motion of the car. The Nash and Lafayette front door glass is partly cut away at the forward top side and a closely fitting ventilating wing closes the opening or acts as an air scoop.

Aluminum, becoming increasingly popular as cylinder head material, plays an important part in the modern engine. Due to its great heat conductivity, higher compression ratios are possible. Silicon aluminum alloy pistons of the T-slot type are being used by Lincoln, Cadillac and Studebaker. The pistons are given a protective metallic coating of 0.0005-inch thickness. After being completely machined the pistons are given a reversed electroplating process in a solution of sulphuric and oxalic acids and water at a temperature of 85 degrees for forty minutes.

Interchangeable, lead-bronze, steel-backed bearings are being used for crankshaft main and connecting rod lower-end bearings. The cast crankshaft in the Ford 8 is made of high carbon alloy steel with a high copper chromium silicon content providing a hard surface and a self-lubricating effect due to the graphitic content. The crank pins are cored out, reducing the weight of the shaft over the previous forged one.

Rubber still predominates in engine mountings. On the Graham 6 rubber-bushed links at each side support the front end of the engine, their center lines passing through the oscillation center.

Reinforce Car Bodies

Frames have been considerably reinforced in order to provide high torsional rigidity. This is particularly the case with individual wheel suspension where the reactions directly on the frame are more severe than with the conventional suspension. The Buick frame has a rugged front cross member and reinforcing braces between the bars of the X-member and the side rails which were found necessary to eliminate frame weave.

The Terraplane and Auburn bodies utilize a steel plate to which the cowl and side panels are welded. The plate is in turn bolted to the frame making to all intent a unit structure of frame and body. Fig. 2 shows the Terraplane construction.

One of the outstanding power plants is the supercharged Graham DeLuxe 8. It embodies a centrifugal blower, Fig. 7, having a high-strength aluminum alloy rotor within a water jacketed cover. It is driven from the rear end of the

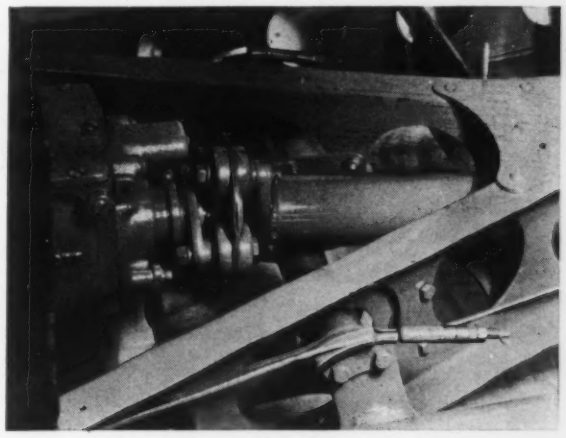


Fig. 5—Rubber blocks within stamped cups are utilized in universal joints

water pump shaft by a Cone worm gear drive at a ratio of 1:4.7 or 1:5.75 with the crankshaft.

A new metallic facing for the clutch driven plate has been developed by Spicer. This replaces the asbestos lining and runs without oil. A slightly larger clutch is needed due to the lower coefficient of friction but the average car can be started in high without deterioration of the clutch, due to the slipping ability of the material. In the Plymouth clutch woven lining is used on one side of the driven member and molded material on the other.

A new type of rubber universal joint has been

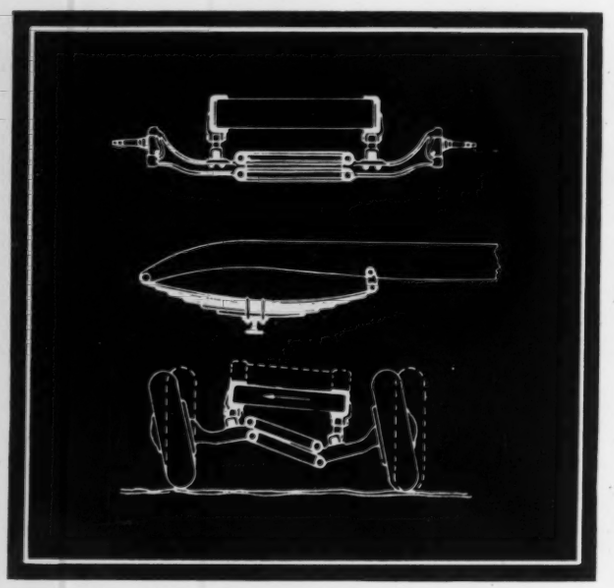


Fig. 6—Torsional rigidity of the springs opposes the tilting of the axle ends

introduced on the Nash in which four rubber blocks are contained within two pressed steel members. Each pair of opposed blocks is attached to a shaft spider as shown in Fig. 5.

Generator Output Increased

Increased output of generators when the lights are turned on is provided by Oldsmobile and Cadillac. This system is known as the lamp load type. In place of a fuse or circuit breaker, Cadillac provides a current limit thermostat consisting of a bi-metal blade with silver contact points in series with the light circuit. Current flowing through it generates heat and the design and adjustment is such that when 20 amperes flows with an ambient temperature of 210 degrees Fahr. the contact points will open. No current will flow then until the blade recools and the contacts again close. The Packard and Cadillac generators are provided with a screened horn intake to ventilate the interior of the generator. Hudson provides fan blades on the back of the fan pulley, which circulate air through the generator from the rear to the front.

Centrifugally controlled clutches are being offered by Spicer and Long. The former has a control button on the instrument panel whereby the clutch can be converted to the conventional type if desired. The mechanism can be either in the form of a mechanical latch or a vacuum cylinder. In the Long arrangement the vacuum cylinder is in continual communication with the intake manifold and the clutch automatically becomes conventional when there is little or no vacuum.

Vacuum spark control is being used by a greater number of cars. The vacuum in the intake manifold is also utilized in the coincidental starter where the movement of the accelerator pedal starts the engine and the vacuum developed withdraws the starter control interconnection. Nash however utilizes the clutch pedal instead.

The direct acting shock absorber application results in lower pressure on the shock absorber oil, since the displacement is much greater than in the ordinary type. By making the restricting port shallow, thermostatic compensating means

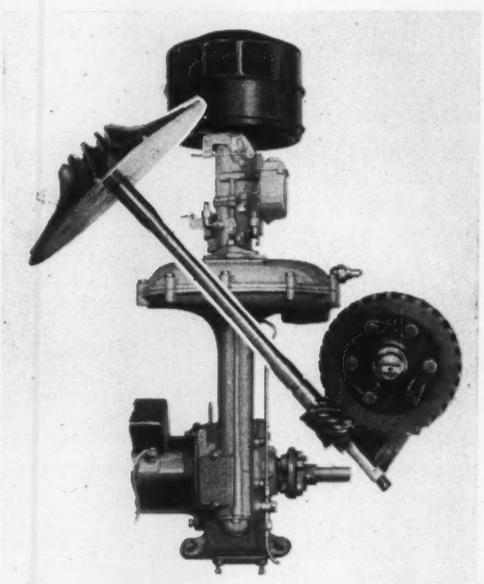


Fig. 7—Supercharger has an aluminum alloy rotor with water-jacketed shaft mounting

become unnecessary. In the Monroe shock absorber the cylinder is secured to the axle and the piston and its rod to the frame. A reserve chamber surrounds the working cylinder.

Hydraulic brakes are being employed by Oldsmobile and Auburn but differ from previous construction in the use of a single piston. The cylinder instead of being stationary exerts pressure against one of the brake shoes.

SCANNING THE FIELD FOR IDEAS

IMPORTANCE of the transference of ideas was brought out in a discussion with an engineer recently. He was working on a secret process that involved several factors which were new to his type of work. The method to be used to accomplish the desired result had him puzzled. Then one day while visiting a plant in an entirely different field he saw a machine that embodied a mechanism applicable to his problem. Although the products were absolutely different, the processing of the other yielded an idea that warranted consideration. With certain modifications he was able to utilize this idea with complete success. All of which goes to prove that every engineer in his 1934 resolutions would do well to make a solemn vow to be more cognizant of what is being done by others in his profession. It may save him much lost sleep.

OBVIATING RATCHET OVERTRAVEL

CHECKING over recent devices which offer the designer ideas that may assist him, attention is drawn to the method of locking register wheels against overtravel employed in the Chronolog developed by National Acme Co., Cleveland. In this mechanism, Fig. 1, a solenoid plunger attached to the lower end of indexing hook *C* pulls the hook down. Thereby, the register wheel *A* is indexed one-tenth turn. At the completion of the downward stroke the hook rests against stop bar *D* and the register wheel which has been brought into rapid motion is blocked against overtravel by butting against the flat face of the hook. Dog *E* locks the wheel against rebound. A spring (not shown) mounted obliquely to the hook returns it to the upper position.

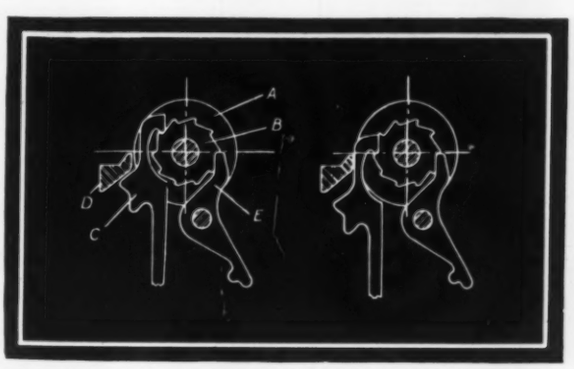


Fig. 1—Overtravel of recording wheel is prevented by flat face of hook which abuts ratchet

During stages of development an attempt was made to reverse the operation; that is, to have the solenoid plunger pull down a push rod, compressing a spring during this movement for storing energy to index the register wheel on the return stroke. However, due to a freak action caused by the combination of an alternating-current solenoid and a spring, the indexing was not dependable and occasionally the register wheel would over-count. The foregoing mechanism then was devised.

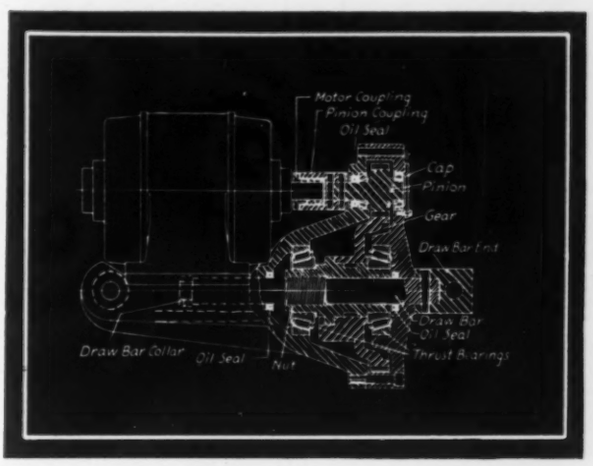


Fig. 2—Combination of motor-actuated nut and threaded shaft effects clamping action

CLAMPING BY HIGH TORQUE MOTOR

OFTEN the designer is called upon to provide an idea for a mechanism that will actuate a draw bar in a forward thrust or exert a pulling force. Such a device might be required to operate clamping fixtures, power clamps on shears or welding machines, as well as for molding

equipment handling rubber, clay, plastic materials, etc. Those confronted with a problem of this nature will be interested in the design of a new pull-push power unit, Fig. 2, (page 17) developed by Cushman Chuck Co., Hartford, Conn.

Rotation of a nut turning on a thread of a drawbar causes the drawbar which is supported rigidly in the housing at each end, to move either forward or backward according to the direction in which the high torque motor is running. No provision is made to prevent the drawbar from rotating, as it is intended that when the unit is applied to a machine, the designer of the latter will fit both sides of the drawbar end and provide means to obviate rotation.

One of the features of the unit is the hammer blow exerted to insure instant release of the work. Before picking up its load, the motor makes several free revolutions. On the rotatable nut there are abutments; when these abutments contact, the motor is in full speed and this speed multiplied by the inertia of free movement of the rotor enables the abutment on the gear to deliver a powerful blow on the abutment on the nut. Designs available include either flange or base mounting. Assembly with a machine is possible in any position from vertical to horizontal.

MAGNETIC UNITS AID AUTOMATICITY

RECENT applications of the principle of magnetism to operation of mechanisms are augmented by the announcement that Monarch Machine Tool Co. now has developed a lathe electrically controlled throughout. The unit, Fig. 3, employs magnetic clutches for carriage, tool slide feeds and rapid traverse as well as a magnetic clutch and magnetic brake for spindle operation. Limit switches accurately control diameters and length of cuts; no cams are used.

In the front gear box are four magnetic clutches; two of them provide length feed and rapid traverse return to the front carriage. The other two magnetic units, through a feed rod and simplified gearing in the apron, effect in-feed and out-rapid-traverse movement or vice versa to the front carriage tool slide.

The design of this new machine tool characterizes the trend toward increased automaticity, a factor that will play a most important part in the movement toward shorter working hours with no decrease in production. Designers may expect to be called upon to contribute continuously ideas that will meet the requirements of the new order.

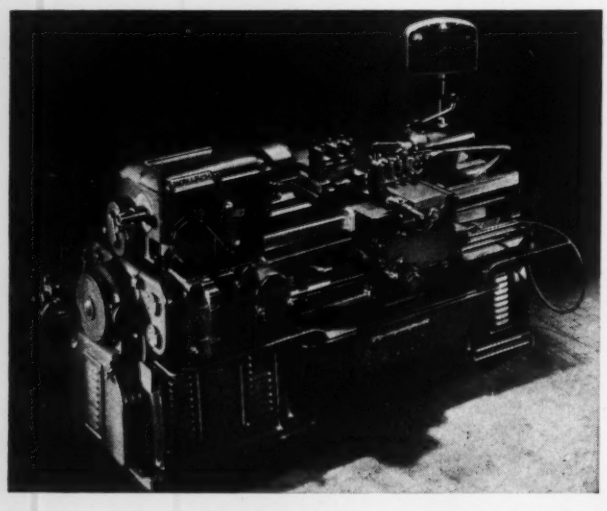


Fig. 3—Increased automaticity is provided in this lathe by use of magnetic clutches

ANALYSIS BY ELECTRICAL RESISTANCE

OPERATING principle of a recently designed gas analyzer reveals an interesting idea for use of a wheatstone bridge. The instrument is employed to test furnace atmospheres, detect explosion hazards or for any other industrial application where it is important to have exact knowledge of the presence and amount of combustible gas in air and gas mixtures.

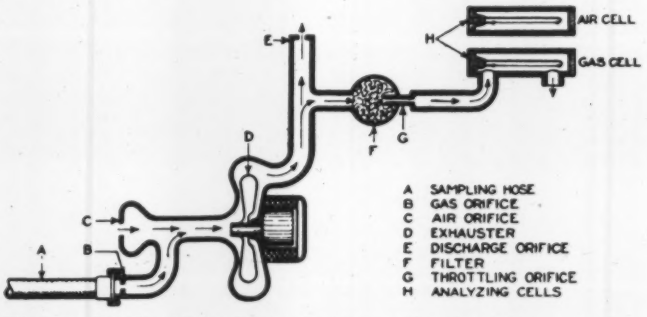


Fig. 4—Combustion along platinum wire increases its electrical resistance in analyzing gases

A sample of the gas to be analyzed is passed at constant velocity through a gas cell, Fig. 4, containing an electrically heated platinum wire. The combustible gases in the sample are burned catalytically along this wire, and the electrical resistance of the wire which consequently is increased, then is compared to that of an identical wire mounted in another cell that contains air and is sealed. The two platinum wires are arranged to form two arms of a wheatstone bridge, the other two arms of the bridge being fixed resistance coils.

Since the wire in the air cell always maintains itself at a constant temperature and resistance, any increase in the resistance of the wire in the gas cell throws the bridge out of balance and causes a deflection of the galvanometer. This deflection is proportional to the combustible

content of the gas under analysis, and the galvanometer scale is calibrated in per cent of combustible gases. Bacharach Industrial Instrument Co. is the manufacturer.

REGENERATIVE BRAKING OF ROLLS

DESIGNERS dealing with problems in braking may find a good suggestion in the use of an electrical regenerative braking system, Fig. 5, for the unwinding stand of paper machine winders. In this type of unit the maintenance of proper tension in the paper as it goes into the winder contributes materially in improving the characteristics of the rewound roll. It also serves to avoid the loss of the power dissipated in mechanical braking.

Braking effect on the unwinding reel is obtained by connecting to it, through a gear, a generator whose armature output is fed back to the armature circuit of the winder motor. Current returned by this braking generator is proportional to the tension in the paper as it passes between the unwinding reel and the winder drum. A current regulator is utilized to regulate the field of the braking generator as the reel changes in diameter, so that the current output of the generator is maintained constant.

Tension may be obtained in the paper with the winder at standstill and when operating at

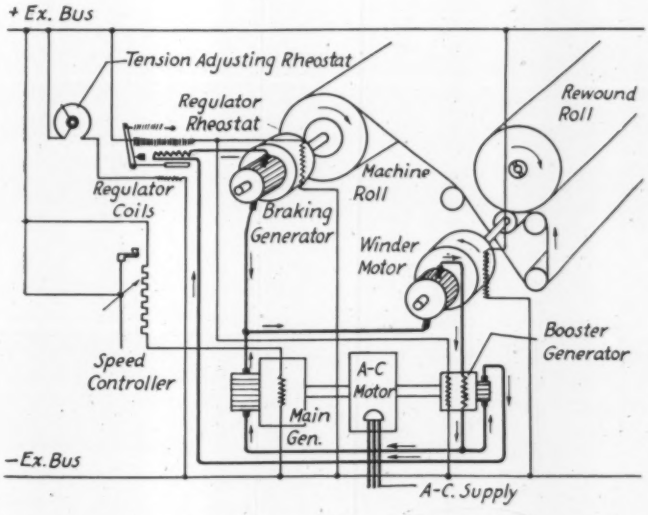


Fig. 5—Schematic diagram of variable voltage winder drive with regenerative braking tension control

low speed in starting a new roll. For this operation an auxiliary low-voltage generator is supplied as a part of the main motor-generator set. The armature of this booster generator is connected in series with the braking generator and has a voltage capacity just sufficient to compensate for the resistance drop in the armatures of the braking generator and the winder motor. Thus, excitation of this booster generator causes the current to circulate between the braking generator and winder motor and creates tension in the paper.

Use of this booster generator eliminates the necessity for the operator to hold back on the winder rolls to keep slack out of the paper as the winder is being started, and also assists materially in obtaining a firm-centered roll as the winder starts. General Electric engineers developed the system.

WILL STEAM PROPEL FUTURE PLANES?

ENGINEERS for nearly 100 years have been anticipating the use of a steam engine in airplanes. Because water boils at lower temperature at high altitudes than at sea level the

Fig. 6—Airplane equipped with steam engine proved feasibility of this type of power

use of this type of motive power naturally is desirable. With purely an experimental motive, two brothers, George and William Besler, some time ago installed a steam power plant in a Travelair plane, Fig. 6, and made successful flights. The installation was consummated with the close co-operation of the Boeing School of Aeronautics, Oakland, Calif.

From an historical point of view it is interesting to note that the rise of the internal combustion engine and its success in Wright brothers' airplane of 1903 centered attention on gasoline engines and early experiments with steam were dropped by the pioneers in the field. Apparent-

(*Concluded on Page* 61)

Infinite Speed Variations Obtainable with Hydraulic Transmission

By Allen F. Clark
Associate Editor, Machine Design

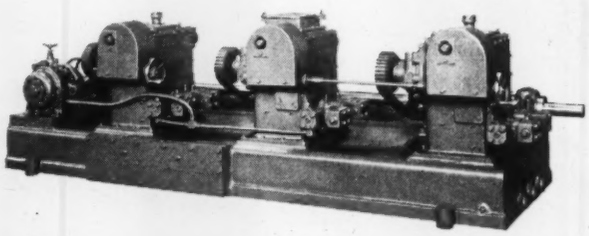
LONG before any of today's active designers were born, hydraulic mechanisms had gained such popularity that the city of London was piped for hydraulic power. The utilization of hydraulics in one form or another is recorded frequently in the pages of history, each application a forward step. Considering this venerable lineage, it is little wonder that hydraulic mechanisms continue to be chosen with regularity by designers of all types of machinery.

Complete flexibility in design has almost become a fetish with engineers. Hydraulic mechanisms permit this flexibility. They not only permit it, but they give even greater leeway in the design. Beyond the widely variable specifications afforded in drive characteristics, hydraulic mechanisms are fully flexible in location, it being possible to centralize and group the driving members anywhere desired with only two tubes leading to the hydraulic motor driving the parts.

As pointed out in the article on mechanical variable speed transmissions on page 29 of the December issue of MACHINE DESIGN, the speed of operations is the only factor in the operation of a machine that can be adjusted by the user. Mechanical variable speed mechanisms will give precise speed control; variable speed motors and electrical controls, to be discussed in a forthcoming issue, also will provide such control; hydraulic variable speed transmissions, the subject of this article, form another group of parts which will give precise, infinitely variable speed control.

Design and characteristics of the variable speed units themselves having been discussed in earlier issues of MACHINE DESIGN and in numerous additional articles, they need not be considered here. All of the units now on the market have been proved satisfactory by application. It is not the design of the particular makes that is of value to other designers, but the application, as applications bring out what has been done and the results that can be secured. Thus a designer can see how problems similar to his own have been solved.

The combination of several units to secure synchronized rotary movement is shown in Fig.



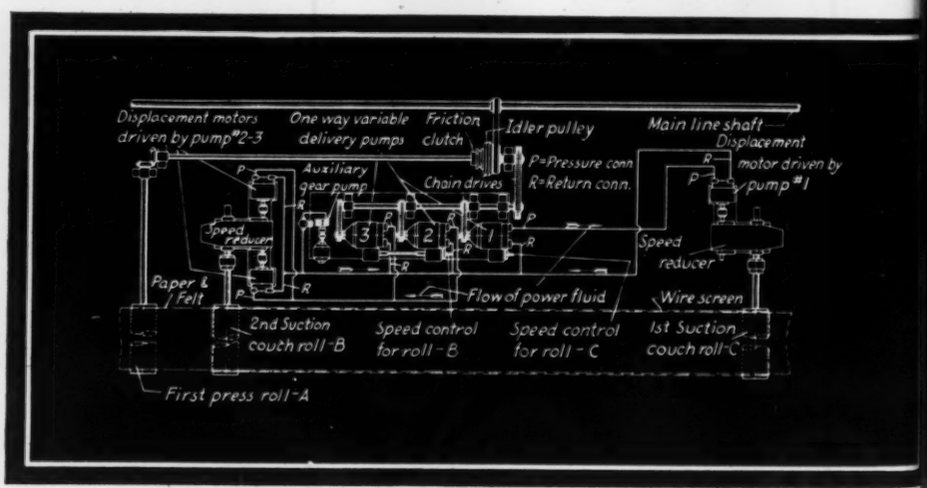


Fig. 1—(Above)—Three driving pumps are grouped, receiving power from same shaft. Fig. 2—(Below)—Synchronized rotary motion is secured by combination of several units

with Flexible

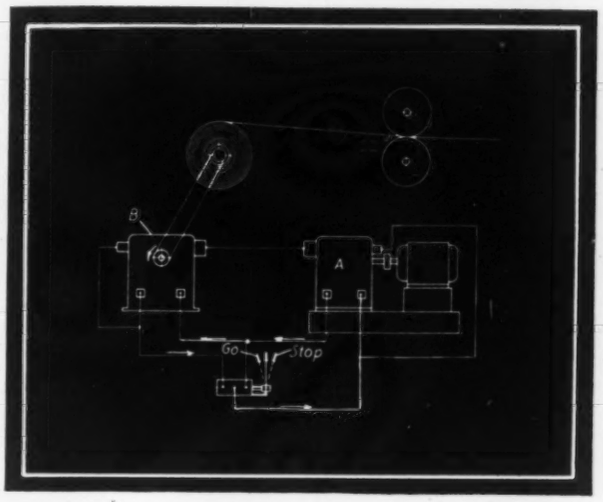


Fig. 3—Speed of reel is adjusted as material is wound on it, enlarging its size

2. This design is a two-roll variable speed sectional drive which uses the same type of equipment as is used in a complete sectional paper machine drive. The two suction couch rolls must be driven at speeds always proportional to the first press roll and to all of the other rolls on the machine. Power for the first press roll is delivered by a jackshaft through bevel gearing and a friction clutch from the main lineshaft which drives all of the other sections of the machine.

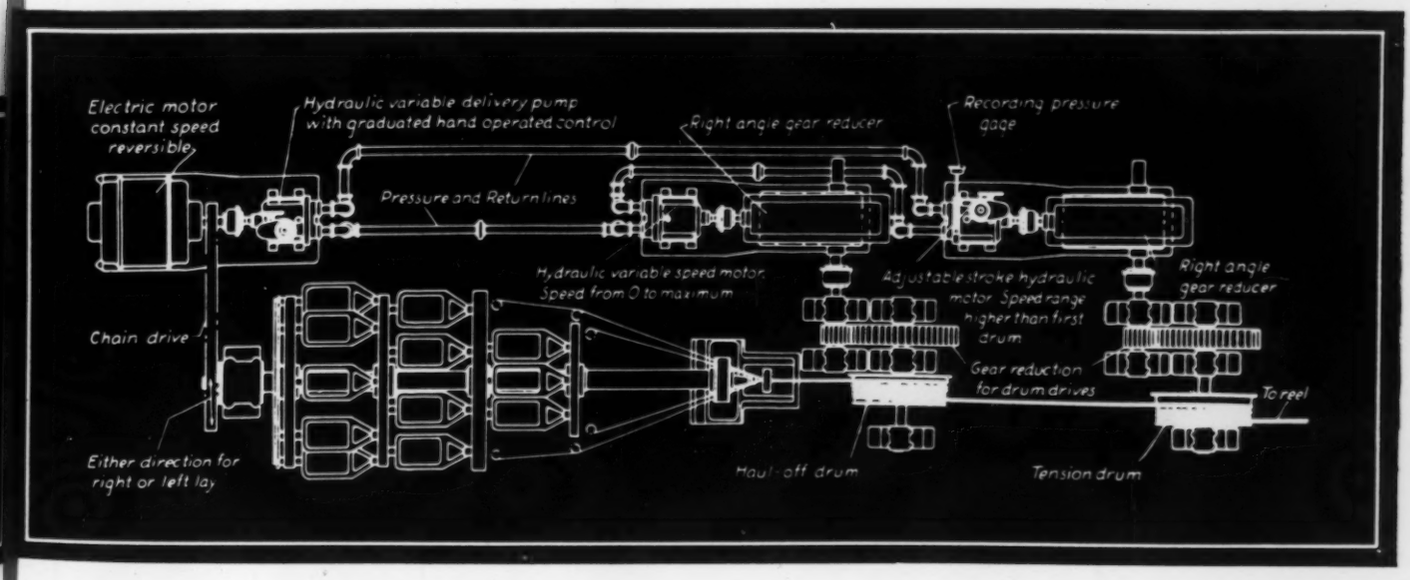
Three pumps, Fig. 1, and three hydraulic motors are used to drive the two suction rolls with the initial power again being taken from the jackshaft. The power required by the second suction couch roll is about twice the power required by the first. In order to standardize the units, all pumps and motors are of the same size, two pumps and two motors, Fig. 7, being used to drive the second suction couch roll and one pump and one motor being used to drive the first. Controls of the pumps 2 and 3 are connected together so that the strokes of these pumps are changed simultaneously.

Relative Speed Maintained

Speed of the couch sections of the machine is varied in direct relation to the speed of other sections by varying the speed of the main driveshaft of the machine, which drives the pumping units. The speed of each roll of the couch section is adjusted independently by means of a handwheel control on the pump. This adjustment is so delicate that the rolls can be exactly synchronized or the speed can be adjusted so that the amount of tension in the felt can be regulated by infinite steps.

By making small adjustments in the delivery of the main pumping unit, the load on the felt can be distributed so that each roll takes its

Fig. 4—Diagrammatic arrangement of cabling machine shows method of maintaining tension and controlling speed


Electric motor constant speed reversible
Hydraulic variable delivery pump with graduated hand operated control
Right angle gear reducer
Recording pressure gage
Pressure and Return lines
Hydraulic variable speed motor. Speed from 0 to maximum
Adjustable stroke hydraulic motor. Speed range higher than first drum
Right angle gear reducer
Chain drive
Gear reduction for drum drives
To reel
Either direction for right or left lay
Haul-off drum
Tension drum

proportionate share, or can be so adjusted that one roll takes a much greater share of the load than the other. The pressure gage shows immediately the effect of any adjustment in the speed of the driving motor. Once the speed or relationship of speed between the two rolls is adjusted, the speed relationship will remain constant unless some change is made in the adjustment of the pumping unit which controls the drive.

Pumps Controlled Electrically

Similar equipment is used in making up a complete sectional paper machine drive, the essential difference being that the pumps are controlled electrically from the machine floor instead of manually as in the foregoing description.

An excellent example of the benefit an hydraulic variable speed transmission can be to the design of a machine is afforded by the wire rope industry and copper cable manufacturing plants where stranding or cabling machines are used. A diagrammatic arrangement of one of these units is shown in Fig. 4. This machine consists of a rotating spider which carries spools of wire or cable. The wire is fed from the spools to a forming die and then around a capstan or haul-off drum. The spider rotates at a constant speed in twisting the wires, and the speed of the haul-off will determine the lay or helix of the rope or cable.

The ordinary type of drive for this application uses various sets of change gears to vary the speed of the capstan. This means an enormous number of sets of gears with perhaps a one-tooth variation in order to take care of the lays desired. In the improved design, Fig. 4, an hydraulic transmission, driven from the same motor that drives the spider, is geared to the capstan drum, Fig. 6. The transmission provides any speed desired from zero to a maximum of the capstan, and when supplied with a suitable control or dial it is a simple matter to set the speed of the capstan for the exact lay desired.

Reversals Are Possible

The spider of the cabling machine may be rotated in either direction depending on the type of rope desired. The capstan, however, must always rotate in the same direction. Therefore, with a change gear drive a reversing clutch is required between the capstan and the spider. The hydraulic transmission, however, will take care of the reverse, thereby eliminating the clutch. as the pump unit can be driven in either direction while the hydraulic motor or variable speed end can be kept operating in the same direction. This drive is positive in actien and does not slip.

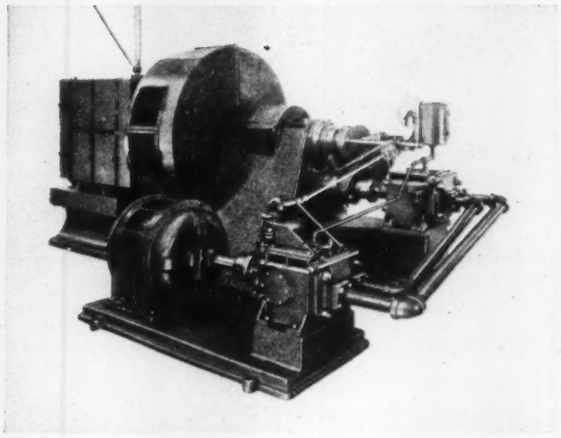


Fig. 5—Hydraulic transmission maintains constant surface speed on slab facing machine

At the extreme right of Fig. 4 is shown a tension drum employed to stretch the rope while it is being made. This second drum is driven from a variable stroke hydraulic motor which is coupled in series with the first capstan drive. The object of this hook-up is to drive the second capstan at a slightly higher speed than the first, and by this means put a tension on the cable as it passes from one drum to the other. The hydraulic motor driving the second capstan has a variable stroke, and is in reality the same as the pump unit. By reducing its stroke, its displacement per revolution is reduced so that for the same volume of oil it will operate at a higher speed.

Can Determine Tension

The original pump unit determines the actual volume of oil delivered to the system. This passes through the first hydraulic motor which operates the capstan to determine the exact lay of rope desired. The same volume of oil is then delivered to the second motor, and by varying

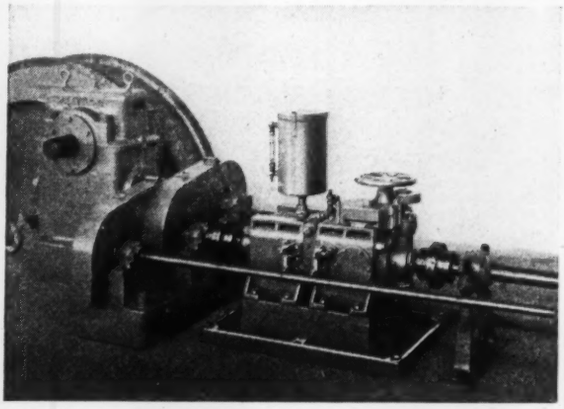


Fig. 6—Lay of rope or cable is determined by speed of drum which is adjustable

its stroke any desired speed differential can be obtained. The tension on the rope can be determined by a suitable formula based on the working pressure in the system. A recording pressure gage can be used to make a continuous record of the tension in the cable as it is being made.

Can Synchronize Rolls

A similar hook-up may be employed to synchronize two different sets of rolls or sections of a printing machine or sections of paper mills. A number of hydraulic motors can be connected up in series in this way, using constant or variable displacement units as desired. The speed of the entire system would be controlled by the original pump unit while each section is operated by a variable stroke motor. Each of these motors would have a speed adjustment entirely independent of the other motors.

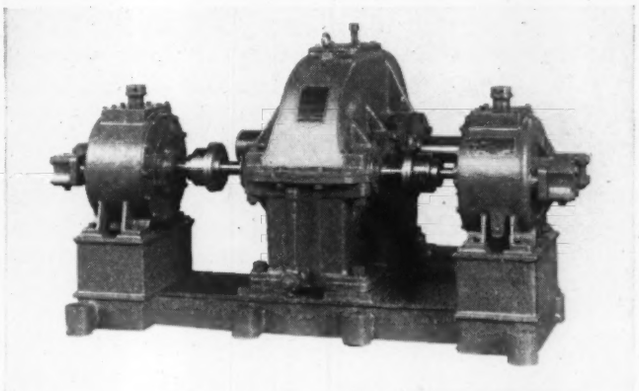


Fig. 7—Two motors are used to drive the roll that requires twice the power of the other

Speed Is Constant

A stepless speed change is obtained on a special slab facing machine, Fig. 5, by use of a variable speed hydraulic transmission. Surface defects are removed from large square slabs of aluminum by the machines before the slabs are sent to the rolling mill. The aluminum slabs are clamped on the surface of a square turret, shown in the illustration, and then swung around in front of the rotating spindle which carries the tool slide. Approximately constant surface speed at the tool is maintained by the transmission which varies the speed of the spindle as the tool is adjusted in or out. An automatic control was developed by the machine tool manufacturer to turn the control stem of the pump unit which in turn varies the speed of the hydraulic motor and the rotating spindle.

One form of constant tension winder drive is shown in Fig. 3. With this arrangement the pull exerted on the material, being wound on reels or rolls, also will be constant regardless of the reel or roll diameter. The equipment consists of a variable displacement pump having an automatic constant pressure control and a variable displacement motor having a similar type control. The material being wound comes to the reel at a constant linear rate of speed.

Variable displacement motor *B*, Fig. 3, drives the reel which winds the material in rolls. Its control is so arranged that if there were no material on the reel it would travel at a higher peripheral speed than the mean linear travel of the material. The displacement of the motor is reduced automatically when the working pressure falls. In this instance, the torque which the motor will deliver is dependent upon its displacement. Thus, assuming that at the highest speed of the reel the motor is operating at one-quarter stroke, the motor torque will be one-quarter or 25 per cent of the full torque.

Greater Torque Required

As the material winds up on the reel, greater torque is required to maintain a constant tension and slower speed is required. The automatic pressure control on the motor automatically increases its displacement to compensate for the increased torque required and thereby reduces its speed a corresponding amount. Pump *A* is equipped with a control so arranged that it normally will set the pump at full displacement until the predetermined working pressure is reached, after which it will reduce the displacement of the pump automatically to a point where it is pumping just enough oil to operate motor *B* at its correct speed.

Development work in the field of power transmission hydraulics has continued actively throughout the last five years. In the larger units, efficiencies and durability have been greatly improved. In the smaller units, developed for obtaining the various functions required in machine tool feeds and other installations where repeated sequences of motions are required, the developments have been characterized by improved designs which solve problems of ever increasing difficulty with simpler and more compact equipment.

For their considerate assistance in the preparation of this article and for the illustrations included, MACHINE DESIGN wishes to thank the following manufacturers of hydraulic variable speed transmissions: The Oilgear Co., and The Waterbury Tool Co.

Articles on this and similar subjects published in previous issues of MACHINE DESIGN include:

"Precise Control Is Possible with New Hydraulic Valves," by Allen F. Clark, Oct., 1933, p. 25.

"Hydraulics Aids Simplification," by Harold B. Veith, Dec., 1933, p. 11.

A listing of earlier articles is included on page 28 of the Oct., 1933, issue.

A.S.M.E. Papers Treat Machine Design

MANY examples indicate that until recently the dominant emphasis in design of machinery has been on the adaptation of man to the machine, rather than upon the adjustment of the machine to the various human limitations. These examples are indicative of the findings of Allan H. Mogensen, authority on motion study, who presented a paper on this subject at the machine design session of the annual meeting of the American Society of Mechanical Engineers held in December. Keen interest was displayed by the designers attending this session.

"It almost seems as if the men who design machines have no conception of the motions the operators must go through in order to use them," Mr. Mogensen stated, basing his belief on investigation of conditions in plants he has studied. He feels there are countless places where the equipment used makes proper co-ordination of hand motions impossible, and that there are two main reasons for this failure to take advantage of motion-economy study. The first is a lack of realization of the significance and importance of motion economy, and the second a lack of understanding of the principles involved.

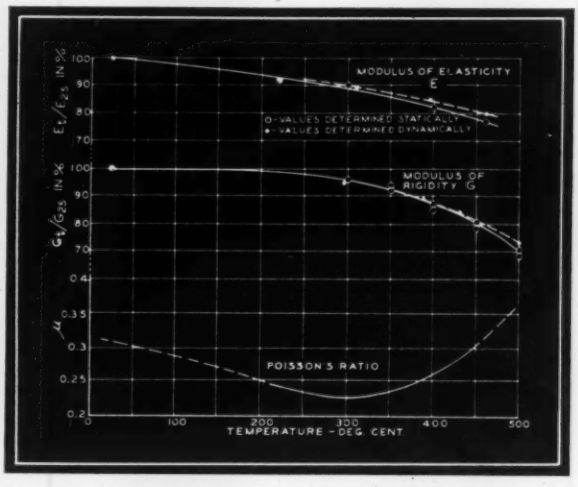
A distinct trend has, of course, been evident for some years toward the centralization of controls and ease of operation in the design of certain types of equipment. The end has not by any means been reached, however.

Appearance Is Discussed

Another paper presented at the machine design session covered appearance in design. Walter D. Teague, design consultant, stressed the important role the artist is playing in industry and referred to the desirability of collaboration between the engineer and the design consultant. He feels that the latter has, in general, a sincere appreciation of the engineer's practical common sense of his problems—an appreciation which facilitates the setting up of an eminently satisfactory working arrangement between the two.

Photoelestic determination of stresses in machine members was discussed at one of the applied mechanics division meetings. It was shown that two-hour strain time tests had been run on bakelite and phenolite, and the conclusion reached that stress distribution in models of these materials does not change in the two-hour period from that occurring in the first few minutes after loading. Celluloid on the other hand varies with the length of time the load has been applied.

Other meetings which attracted designers of machinery and equipment covered: A new method of testing in investigating the wear of bearing metals under service conditions; elastic properties of steel at high temperatures; elastic behavior and creep (in which paper the results shown in the chart above were disclosed); three papers on lubrication and the testing of lubricants; design of the airship; working stresses and the design of springs.



Variation of modulus of elasticity, modulus of rigidity and Poisson's ratio with temperature for medium carbon steel

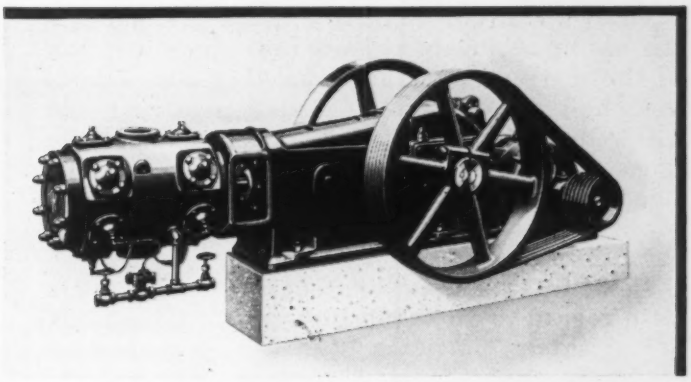


Fig. 1—Single-stage construction is simplest and best solution in compressor design

Materials Selection Is Factor in Compressor Design

By Paul Hoffman

Chief Engineer, Ingersoll-Rand Co.

DESIGN of compressors, like that of other machinery, is continuously undergoing changes. However, compressors, in common with other engineering products which look back upon a long period of development, have reached a stage where their development, at least in its essentials, has become pretty well stabilized. By the process of trial and error certain basic designs have been found to answer the requirements best. Radical innovations are hardly to be expected at this stage and, on the whole, improvement is rather along the lines of refinement of detail and of complete adaptation to practical use.

The type of compressor described in this article is presented as an example of design which satisfies a given purpose rationally and adequately. Type ES air or gas compressors, Fig. 1, are made in a number of sizes which cover the range of small to medium capacities and of pressures from 5 to 150 pounds per square inch, corresponding to 10 to 125 B. H. P. In this range single-stage construction is the simplest and best solution. The remainder of the design was determined by two main specifications derived from the nature of the application, which is heavy duty, continuous service. These specifications are: Complete reliability—which means low maintenance cost; and best attainable efficiency—meaning low operating cost.

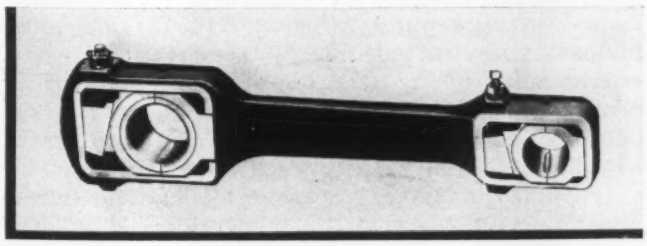


Fig. 2—A one-piece die forging is utilized for connecting rod with wedge-adjusted bearings

Requirements Govern Design

The first requirement calls for moderate rotative speed before anything else. This, on the other hand, means a relatively long stroke which in turn leads, as the best design, to a crosshead type running gear and a double-acting cylinder, in a horizontal arrangement. (High rotative speed, by contrast, leads just as naturally to a short stroke, trunk piston, vertical construction).

A crosshead of the marine type, Fig. 6, is used. It is made of malleable iron, a material which has proved to be the best for this purpose, and is fitted with a shim-adjusted, cast iron

wearing shoe. This marine construction permits the use of removable covers over the entire top of the main frame. The connecting rod, Fig. 2, is a one-piece die forging. Bearings at each end are wedge adjusted, the adjustment being made by a single bolt. Crankpin boxes are babbitt lined and the crosshead boxes are of solid bronze. They can be removed for inspection with the rod in place.

Demand for reliability requires conservatism with regard to allowable stresses, or a high factor of safety, particularly in all members subject to reversing forces. This means a relatively heavy machine, although weight as such is no proof of safe design and only weight properly applied is what counts. Besides, higher grade materials are often a better answer than mere bulk, not forgetting, of course, that appropriateness of materials must always be the deciding factor.

That workmanship of a high order is likewise necessary to produce reliable operation perhaps need not be stressed; the effects of correct fits and clearances and of proper surface finish of any rubbing parts are quite obvious, but these factors usually escape the direct control of the designer.

Commercial Possibility Considered

The other principal demand made on the ES compressors is best attainable efficiency. As to this, the limitations imposed on the designer are at once apparent: Cost is usually an effective brake on his efforts to realize the best possible, and his endeavors therefore are confined to the best that can be produced commercially.

To illustrate, it has already been mentioned that one of the available means for improving efficiency, that is, compounding or two-staging, with intercooling, is not applied to this type compressor. This advantage is abandoned deliberately, in small and medium size compressors, because of its inherent complication and cost.

Within these limitations much remains that good design can accomplish. Thorough application of water cooling is one such point. This means jacketting not only the cylinder walls, but also the heads, giving particular attention to surrounding the valves completely with water and cooling the air passages from and to inlet and outlet connection. Fig. 4 a cross section of the cylinder showing the arrangement of valves and water jackets indicates how this has been done.

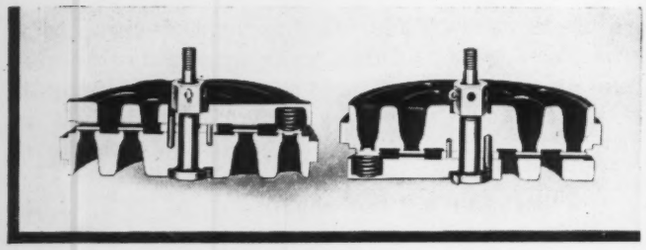


Fig. 3—Valve efficiency is secured by large streamlined port openings and large lift areas

Lowers Air Temperature

The immediate benefit is, of course, a lowering of the air temperature and of its volume, therefore a lowering of the power required for compression. Incidentally, lower cylinder temperatures mean better lubrication with less oil and this results in the elimination of valve leakage and breakage due to their clogging by carbonized oil.

There is further scope for the designer in valving a cylinder. The design of a valve offering least air resistance, combined with unlimited durability, has long challenged his ingenuity. Here are some of the partly contradictory requirements: Valves should be small but should have large port and lift areas; the moving element should be light but possess strength and endurance, and, in addition, it should resist wear, warping and corrosion. In the ES compressor these requirements are met by plate valves made of heat-treated stainless steel. Efficiency is secured by large streamlined port openings through the valve seat and stop plate, Fig. 3, combined with large lift areas under the valve plate. The valve assembly can be taken apart quickly for periodic inspection.

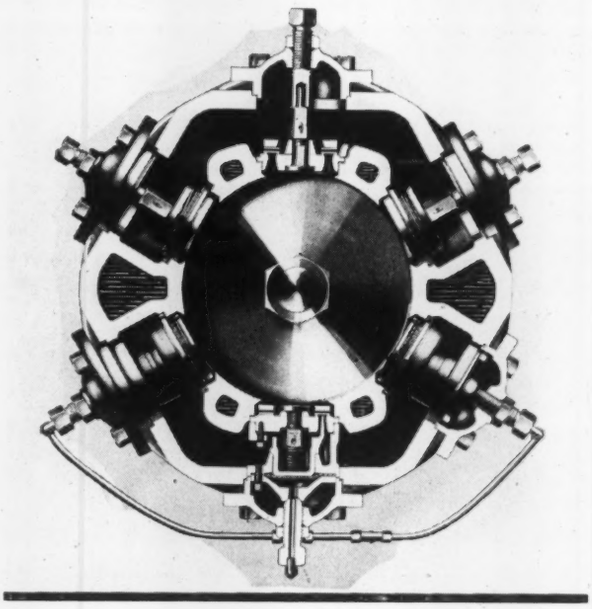


Fig. 4—Valves are surrounded completely with water and air passages are cooled

To unload the cylinder when full output is not required, and also when the compressor is

started, the inlet valves are held open by the free-air unloaders. This lets the air or gas move in and out of the cylinder without compression. Each inlet valve is equipped with an unloader of the diaphragm type. Unloaders are operated by compressed air or gas from the receiver, and may be controlled by several types of regulators.

The problem does not stop at the design of the valves themselves: Number and disposition of the valves in the cylinder are equally important. The total area of all the suction and discharge valves must be properly related to the piston area, so as to keep the air speed and the resulting losses through the valves within acceptable limits. The proper disposition of the

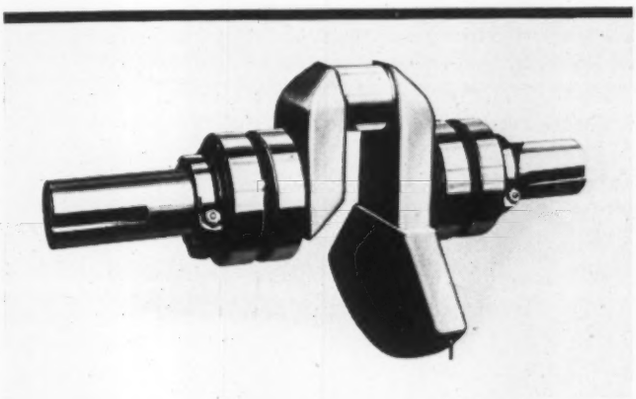


Fig. 5—Four rows of bearings are employed to support the shaft against crank thrust

valves determines largely the total clearance space behind the piston, therefore the volumetric efficiency of the machine or its ability to deliver a maximum volume for a minimum expenditure of material.

Oversize Bearings Used

Main bearings on this compressor are oversize, double-row tapered roller bearings. With the double-row mounting, the inner bearings are close to the crankpin, Fig. 5, while the outer bearings reduce the shaft overhang. Thus, the four rows of bearings support the shaft rigidly against the crank thrust and the belt or armature pull. This construction also makes possible one floating main bearing to allow for shaft expansion without strain on the frame, shaft or bearings. Special shaft stuffers prevent oil working along the shaft.

Attention to these and other numerous points is what distinguishes a compressor. On the surface, mechanical details may look alike. Many compressors now are fitted with roller bearings; the frames may outwardly be quite similar; shaft, connecting rod or crosshead may not appear much different, schemes of regulation and unloading may be produced by similar means. Yet, the last refinement of all these details is

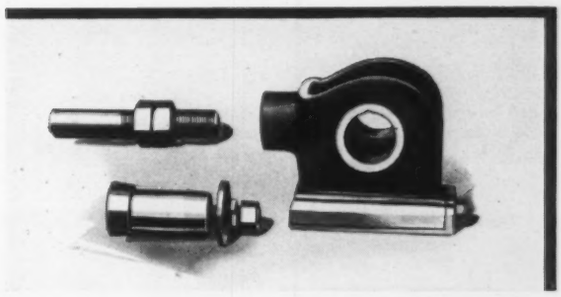


Fig. 6—Malleable iron has proved to be best material for crosshead

necessary to attain continued good performance. From the viewpoint of the designer, this means perhaps less inventiveness than the faculty to take infinite pains. In addition, it calls for a complete familiarity with past experience and practice and the readiness to utilize any new developments in metallurgy or manufacturing methods. Designing along these lines is not flashy or sensational, but it produces sound results.

They Say—

"Throughout the entire development of this country, and even back to the beginning of the modern industrial age in the Old World, the moving forces making for economic progress have been scientific research, invention, organization, management and co-operation."—*Industrial Standardization* for December.

□ □ □

"Under the new order of things our technical endowments are no longer a curse, making unemployment because of overproduction a necessity. No longer is the world too large to be manageable. What we are doing is to apply the same thought and intelligence to social organizations that have gone into the development of our mechanical contrivances."—Hon. Robert F. Wagner.

□ □ □

"When we look at the products of industry, we see ample evidence of excellent designing talent on the part of the engineer. Indeed, the outstanding contributions in the way of significant form in products must be credited to the engineer and not to the artist. Then why the need for the artist in industry if the outstanding developments in exterior appearance are the work of engineers? Simply because the division of labor has been extended. It is too much to expect the engineer not only to design the functional units and processes of a machine, but to give it adequate external form as well, because the engineer is not always an artist."—Joseph Sinel.

New Research Book Discusses Materials

Other New Volumes Cover Industrial Problems and Standardization

Romance of Research

By L. V. Redman and A. V. Mory; published by Williams & Wilkins Co., Baltimore; available through MACHINE DESIGN *for* $1.00 *plus* 15 *cents postage.*

For an engaging treatise on research that will appeal to the average engineer, this book meets the requirement. The authors have told their story in a free and readily understandable style which is conducive to a complete perusal of the volume at one sitting (149 pages). The information is authoritative and is worthy of consideration.

The subject is introduced by an outline of the philosophy of research. This, because the first requisite of a research worker is the ability to differentiate between fact and fancy. Reading on we find further explanation of scientific research and progress. Impetus of the past half century along this line is attributed to the increase in the number of capable thinkers and education of the masses.

Particularly interesting are the chapters on materials. First of these sections discusses the role of materials, the second outlines new requirements and new materials, while the third covers the invention of new materials. Concluding episode is an appeal for research in the science of sociology in order that we may catch up with our scientific progress and enjoy the benefits of an unparalleled civilization.

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Human Problems of an Industrial Civilization

By Elton Mayo; published by Macmillan Co., New York; available through MACHINE DESIGN *for* $2.00 *plus* 15 *cents postage.*

Designers, like the machines they create, are embroiled in the transition of the new order. Their thinking no longer can be centered solely on the mechanics of machines—the responsibility extends far beyond that one-time sufficient factor. *The Human Problems of an Industrial Civilization,* title of a newly published book, must be taken into account also and call for attention on the part of the engineer.

With this obligation in mind, designers might profitably examine what the author, Elton Mayo, has to say about the problems of our present era. Subject of the opening chapter is fatigue, treated in a compilation of a series of investigations. Its nature has been studied at length and the conclusion reached that industrial fatigue is something different from physiological fatigue. An extensive inquiry into monotony in industrial work deals with causes and effects and that which can be accomplished to reduce its occurrence.

Woven into the fabric of the thesis is a chapter on industry and society, followed by another on government and society. A significant statement concludes the final chapter, wherein the author speaks of the new administrator: "The universities of the world are admirably equipped for the discovery and training of the specialist in science; but they have not begun to think about the discovery and training of the new administrator."

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1933 Book of A.S.T.M. Standards

Published in two parts by the American Society for Testing Materials, Philadelphia; available from MACHINE DESIGN *for* $7.50 *for either part, or both parts for* $14.00 *plus* 15 *cents postage.*

The society recently issued its book of A.S.T.M. standards, a triennial publication containing all of the standards specifications, methods of test, recommended practices and definitions formally adopted by the organization. The 1933 edition is composed of two parts, Part 1 contains all standards covering metallic materials; Part 2 covers all standards for nonmetallic materials. The two volumes aggregate 2300 pages.

In both parts of the series the specifications for a particular class of material are given first, followed directly by the test method, definitions, etc. A complete subject index together with two tables of contents, one listing standards by materials covered, the other in order of numeric sequence of the designations, greatly facilitates their use.

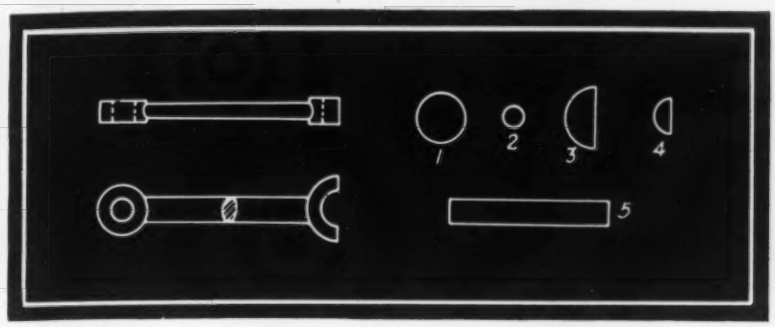
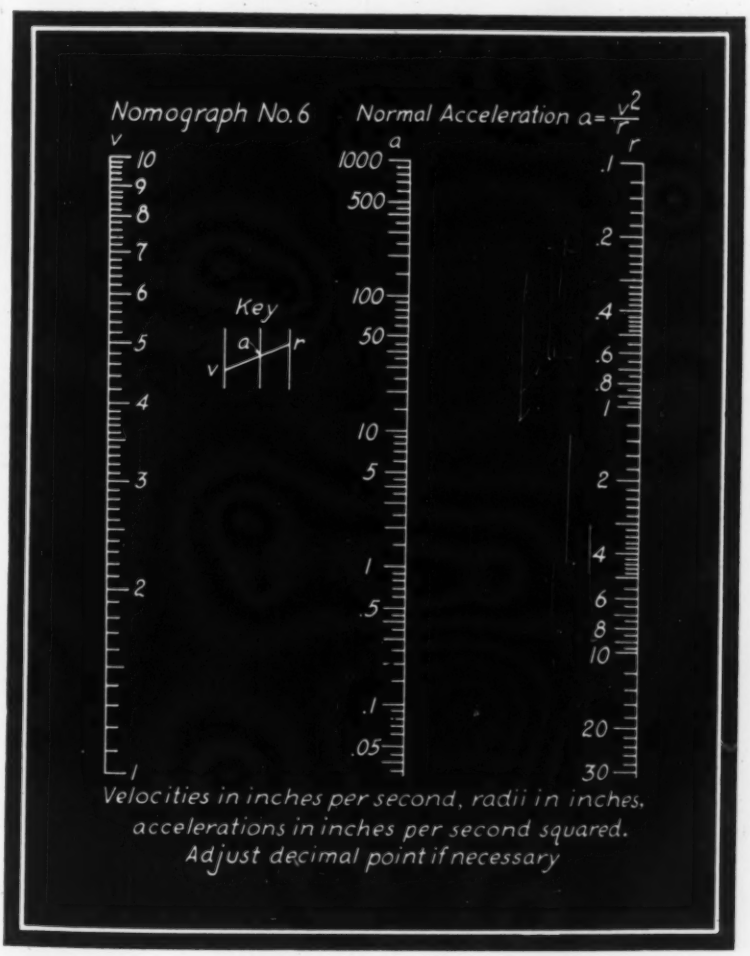


Fig. 1—Weight of connecting rod can be calculated easily by dividing cross section into simple areas

Simplified Calculations Unshackle the Designer—IV

By Joseph Harrington Jr.


Nomograph No. 6
Normal Acceleration $a=\frac{v^2}{r}$
v
a
r
Key
Velocities in inches per second, radii in inches, accelerations in inches per second squared. Adjust decimal point if necessary

IN ORDER to eliminate all calculations except the simple one of addition involved in the force analysis of dynamic mechanisms discussed in the October, November and December issues, nomographic charts published with these articles, have been developed. The first one, (MD., Oct.) provides a means to calculate the weight of metallic parts of simple form—that is parts which have no constrictions or bulges in their length. Round, elliptical or rectangular cross sections of any length can be "weighed." If a part is more complex, it may be split up into units of these simple shapes.

For example, a connecting rod is shown in Fig. 1. The weight of the solid round (1) is calculated, from it is subtracted the weight of the metal in the hole (2). Add the weight of the elliptical rod (5) and the half round (3). Subtract the weight of the metal in the half hole (4) and we have the weight of the connecting rod. All unit weights can be calculated from the nomograph.

The second, third and fourth nomographs (M.D., Nov.) are for the calculation of moment of inertia of the fixed pivot parts. The moment of inertia, like the weight,

is an additive function. We can split up the member into parts whose moment of inertia can be calculated, and then add the moments to get the total for the member. It will be remembered that the moment of inertia of a unit is least when the axis of rotation passes through the center of gravity. It is I_o, a product of the weight and the length (or radius) squared and a constant.

Moment Is Increased

If the unit is not rotating about its center of gravity C, but about some other axis D, then the moment of inertia is increased by adding to it the product I of the weight times the square of CD. The nomographs have two parts each, one for calculating I_o and one for calculating I_1. The second nomograph is for long rods of any cross section rotating about an axis perpendicular to their axes. The third is for cylindrical elements rotating about any axis parallel to their own axes, and the fourth is for rectangular prisms rotating about any axis parallel to their own axes.

The fifth nomograph is for solving the equations $B_v = A_r \times BO/AO$, and $B_a = A_a \times BO/AO$ (MD., Nov. and Dec.). The operation of this chart is obvious. If A_a is too big (or too small) to be found on the scale, divide (or multiply) by 10 or 100 and then multiply (or divide) the resulting B_a by 10 or 100.

The sixth nomograph, herewith provides a solution for the equation $a_n = v^2/r$, (M. D., Nov.), The seventh nomograph, shown herewith, provides a solution for the equation $T = I_{at}/r$, (M. D., Nov.). Either A_t or B_t may be substituted for a_t, and r will then represent AO or BO. The eighth nomograph provides a solution to the equation $F = (W/g) \times a$, (M.D., Dec.). W is the weight of the part and g is the acceleration due to gravity, 32.2 ft./sec. The ninth nomograph aids in finding moments. The equation $M = Fr$ is the general equation for converting forces about a point to moments, or moments back to a force about a point. It also can be used for calculating the product wx used in determining the center of gravity. The scale range of F (or w) runs only from 1 to 10, so that proper location of the decimal point is necessary.

It will be well to review the method of obtaining the center of gravity of a body. First obtain the total weight W by dividing the member into simple units. Then locate by symmetry the center of gravity of each of these units. They are each so simple, cylinders, rectangular prisms, etc., that this can be done by inspection. Assume a system of axes X, Y and Z at any convenient point from which to measure distances. Then if w is the weight of a unit, and x is the distance to the x axis, $x_o = \Sigma\, wx/W$ where x_o is the distance of the center of gravity of the piece from the x axis. Similarly

$$Y_o = \Sigma wy/W, \text{ and } Z_o = \Sigma wz/W$$

This locates the center of gravity completely. If there is a plane of symmetry we know without calculating that the center of gravity will lie in it, and if there is an axis of symmetry we know without calculating that the center of gravity will fall on it. Thus one or two calculations may be saved.

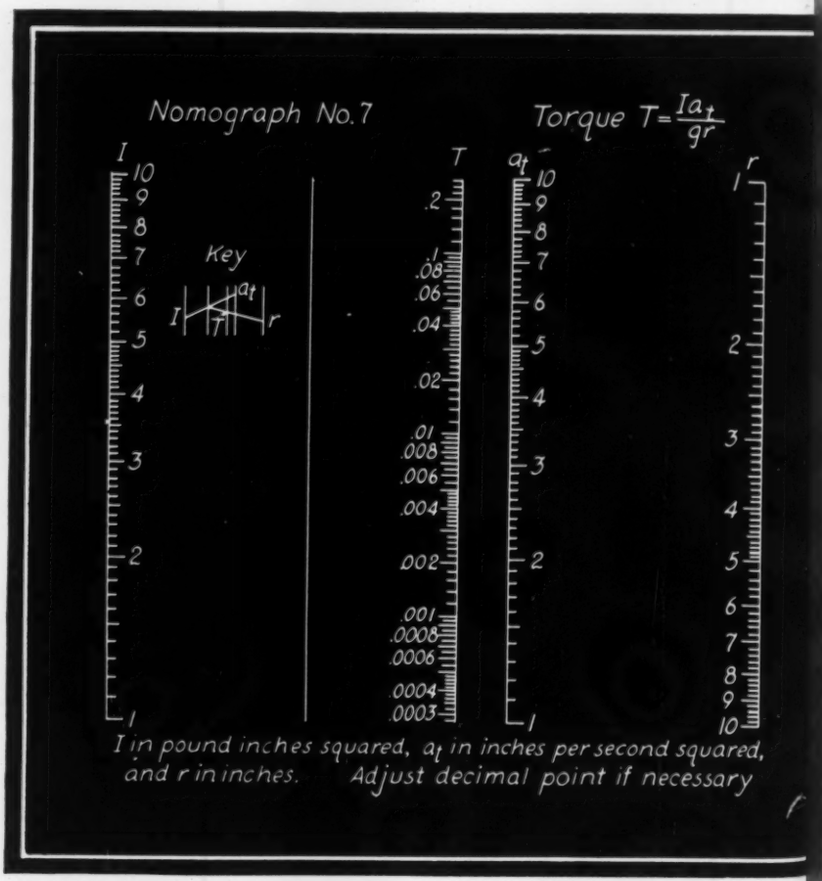
It should now be possible to isolate any piece in the train and supply all of the following information about it:

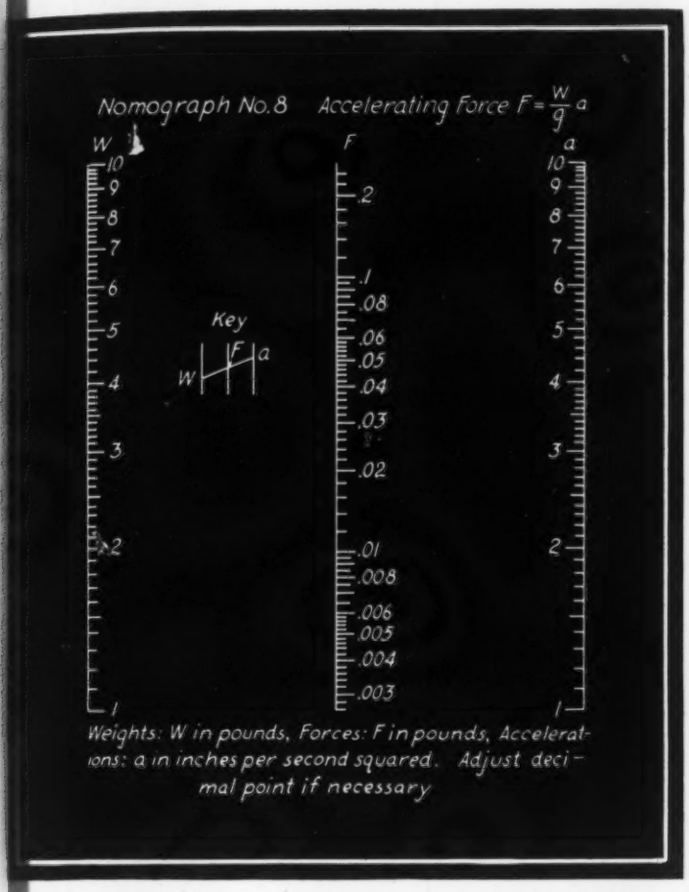
(1) The forces acting on the piece at A and B

(2) The forces acting on the piece at O

(3) The angular velocity of the part about its pivot O (Fixed pivot parts)

(4) The velocity of the A and B points




Nomograph No. 8 Accelerating Force $F = \frac{W}{g} a$
W
F
a
Key
W F a
Weights: W in pounds, Forces: F in pounds, Accelerations: a in inches per second squared. Adjust decimal point if necessary

(5) The linear acceleration of the A and B points

(6) For the first piece of the train, the velocity and acceleration imparted at the working point

(7) For the last piece of the train, the force on the driving mechanism

We can use this information in this way:

(1) tells us what load the connecting units will have to bear. (1) also tells us upon what loads the strength design of the piece should be based. If the accelerations (5) are high, it may be necessary to include the internal stresses arising from the inertia of the part itself tending to deform it.

(2) tells us what loads the frame must be designed to withstand.

(3) and (4) tell us the velocity of rubbing at the points of contact, upon which, with (1), we predicate our lubrication design.

(6) gives us material important to a judgment of how well the train will perform its function.

(7) gives the power input necessary.

A repetition of this analysis for several different positions of the train will lead to some interesting information. It may be found that due to the layout of the train the accelerations of the various parts may not reach their maximums at the same time. It is even possible that, if a cam follower is very light in comparison to some other member of the train, smoother operation will be obtained if the cam is designed to give the heavy member an acceleration producing as little shock as possible, letting the lighter cam follower take whatever acceleration is necessary. If the time of maximum acceleration varies greatly throughout the train, it will be necessary to establish the position of maximum force on each piece before an intelligent design is to be made. This prospect of going through the entire analysis half a dozen times may seem an awesome task, but it is not. Once the weights, moments of inertia, and the driving part accelerations have been determined, a train of a dozen pieces can be analyzed completely in half an hour.

As a summary, we shall recapitulate the steps of the analysis.

I. PRELIMINARY

1. Determine the space-time, velocity-time and acceleration-time curves of the driving mechanism
2. Select the point of maximum acceleration, or any desired point in the cycle
3. Lay out on a drawing board the center lines of the members
4. Determine the weight and center of gravity of the flying pieces and the moment of inertia of the fixed pivot pieces

II. VELOCITIES

1. Select a scale upon which to plot velocity vectors and lay off at point A of the last piece the velocity A_v according to the velocity time plot
2. Find the center of rotation O and draw AO and BO
3. Determine B_v either graphically or by using nomograph five. Plot it
4. Considering this as A_v of the next piece, find B_v for it in the same way
5. Proceed through to the working end of the train

III. ACCELERATIONS

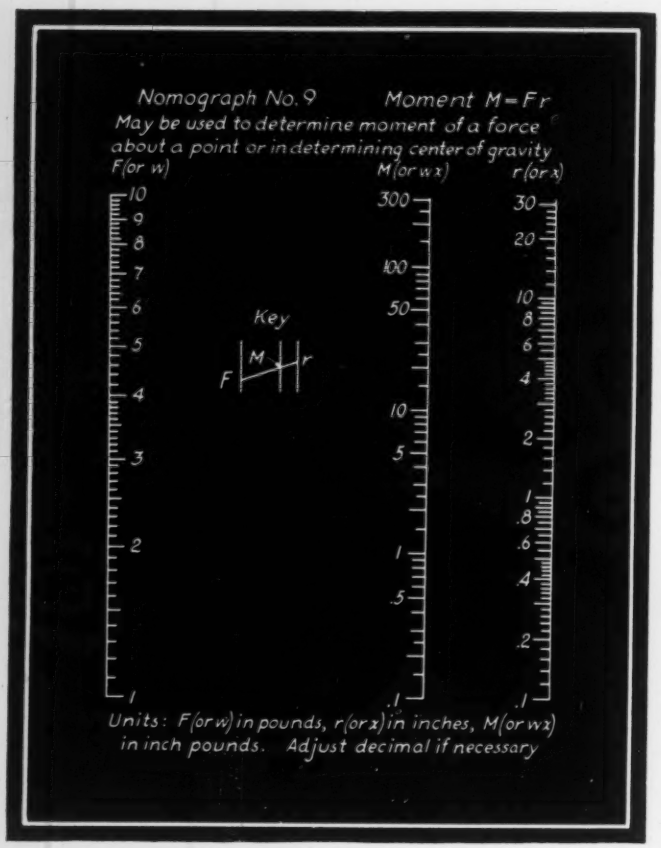
1. Select a scale upon which to plot acceleration vectors and lay off A_a of the last piece according to the acceleration-time plot
2. (a) If this part is a fixed pivot part, find A_t and calculate B_t by the use of nomograph five
   (b) If this is a flying part, calculate w and α and find d
3. (a) If this is a fixed pivot part, find B_a by calculation from B_v and BO, using nomograph six

(b) If this is a flying part, calculate B_a by addition of B_n, B_t and d

4. Determine B_a graphically and plot it
5. Transfer B_a to the next piece and call it A_a
6. Proceed through to the working end of the train
7. Flying parts only: Determine C_a graphically and plot it

IV. FORCES

1. (a) For fixed pivot parts, calculate T by


Nomograph No. 9 Moment M=Fr
May be used to determine moment of a force about a point or in determining center of gravity
F(or w)
M(or wx)
r(or x)
Key
M
F
r
Units: F(or w) in pounds, r(or x) in inches, M(or wx) in inch pounds. Adjust decimal if necessary

use of nomograph seven

(b) For flying parts, calculate C_f by use of nomograph eight

2. Select a scale on which to plot forces and plot the work force applied at the proper point and in the proper direction to the first piece of the train
3. (a) If this is a fixed pivot part, calculate the moment of B_{ft} by the use of nomograph nine and also calculate the frictional moment

(b) If this is a flying part, plot C_f opposite C_a and resolve B_f along and perpendicular to AB

4. (a) If this is a fixed pivot part, add up the moments and calculate A_{ft} by use of nomograph nine

(b) If this is a flying part, determine A_f and B_f according to the method described

5. Plot A_f or A_{ft} and reverse it and apply this to the next part, calling it B_f or B_{ft}
6. If this is a fixed pivot part, compile A_{fn} and B_{fn} and transfer them to O. Reverse them and this will be the reaction of the frame on the member
7. Proceed through to the driving end of the train
8. The reaction on the driving member will give the torque or force necessary to drive the train, from which power requirements can be calculated

It will be noted that the great advantage of this graphical method is its accuracy without drudgery. It also presents a means for the designer to study the effect upon his design of slight changes in shape of the pieces or in layout of the train. At the least it is a potent tool in the hands of the wide awake designer—a practically indispensable one in view of the trend toward fast moving machines capable of high rates of production.

Extended Alloy Research Planned

FORSEEING widespread advances in highway, air and water transportation through the further development of new alloy steels and alloys of the light metals, the automotive industries are joining the iron and steel industries in a co-operative program of research on alloys under the auspices of the Engineering Foundation, research agency of the national engineering societies. The project, sponsored by sixty-eight steel companies and other organizations including the American Iron and Steel Institute, technical societies, research institutes and government bureaus, will be directed by a committee headed by Prof. George B. Waterhouse of the Massachusetts Institute of Technology, Boston, Mass.

As the study progresses, the automotive and steel industries of America will be supplied with information in successive divisions of the subject on which to base attacks on their own special problems in the light of all previous research.

The use of high grade alloys steels in the new spring suspensions of the 1934 model cars is cited as an illustration of the importance of the Foundation's research to the automobile manufacturer and owner. This research looks to the development of special alloy steels of strength and other qualities in a higher degree than are now available.

Die Casting Advances Increase Applications

By R. L. Davis

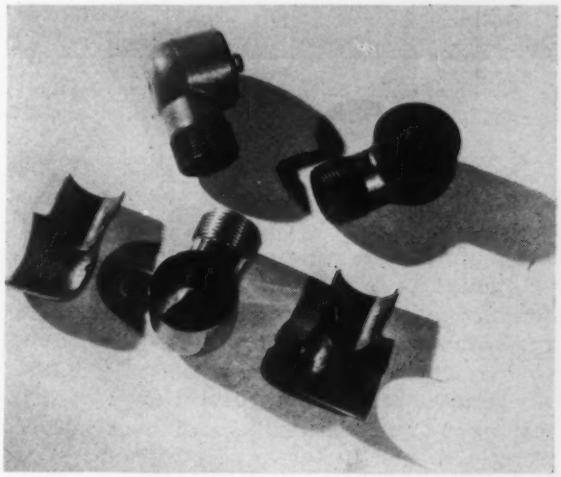


Fig. 1—This spark plug cover with extremely thin section is complete after one operation

NEARLY all designers are aware of the savings in machining and assembly operations effected by the use of die castings, but few realize the increased possibilities arising from developments during the past year. Mr. Davis, New Jersey Zinc Co., shows by applications how the improved physical properties can be utilized.

CONTINUOUS improvement in zinc die casting alloys and the advancement of die casting processes have stimulated the use of this versatile fabrication method through the past ten years. In 1922 the popular alloys contained 6 per cent tin as an alloying component in a base metal with a maximum specification of 1.6 per cent lead, and only small parts for which physical properties were relatively unimportant could be die cast. As is so often the case in early industrial development, we were doing just the things we should have avoided scrupulously. Instead of alloying with tin and lead the entire process is now quarantined to prevent contamination by these elements; zinc of a superior purity is imperative. These developments have produced physical properties superior in some instances and comparable in others to the cast ferrous materials with the exception of alloy steels, as can be seen readily from the accompanying table.

Stimulating Problems Presented

With these improvements in the alloys, die casting practice has been afforded the opportunity of expanding into many industries, all of which have offered numerous stimulating problems. Die design, the flow of molten metal under pressure, the effect of heat elements or cooling jackets in the dies, sizes of gates and overflows, all have been studied carefully and the results will in many cases astound even the well informed mechanical designer.

Former commercial limitations of dimensions and shapes of die castings, limitations as recent as two or three years ago, have been swept away. Weight has been drastically cut by the reduction of wall thicknesses. The spark plug cover, Fig. 1, has, for example, a wall thickness of 0.018 inch. This cover serves as the outside shell for a molded plastic and is used to eliminate the static of the airplane motors in the plane radio. Made in any other way this shell would have to be cast, bored and threaded, or

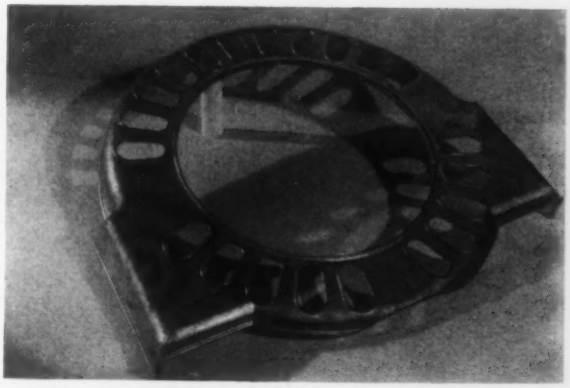


Fig. 2—Large parts as well as small can be die cast with thin wall sections

Fig. 3—Improved physical properties of die castings permit their use for structural members

assembled from a stamping and a screw machine part. As a die casting it can be completed with a simple fin removing operation.

Unusual as is the spark plug shield, it is only a small part. However, the band saw guard, Fig. 2 has an outside diameter of 15 inches, yet the average wall thickness is only 0.055 inch. This demonstrates the possibilities of thin wall sections which, with ribs and bosses for added strength and stiffness have afforded die castings an advantage over other fabrication methods in many applications. Manufacturers of automobile heater shells, clock and other instrument cases have made use of these advantages.

Physical Properties Improved

As they possess tensile strengths of between 40,000 and 50,000 pounds per square inch and impact strengths higher than that of cast iron, die cast aluminum or malleable iron, zinc die castings have in the past two years been adopted for many mechanical and structural members. The cowl bar and windshield frame, Fig. 3, takes advantage of these highly improved physical properties for its structural function. Displacing a manganese bronze sand casting, this die casting shows an economy when made in quantities as low as 500 over a year, even though the problems of making a die and casting this particular part are of major proportions.

The frame for a butcher shop meat slicer, Fig. 4, will illustrate the possibilities for new applications made possible by the added strength of the improved alloys. The use of lugs, ribs and cores are all much simplified by this process. Further, the surface of the part as cast lends itself to smooth, attractive finishes without added labor.

Large Castings Possible

Size limitations of available die casting equipment has been the limiting factor in the maximum size of die castings in the past. Equipment has now been built, however, to produce castings as large as the windsheld frame mentioned in the foregoing which has overall dimensions of 50 by 22 inches and weighs 33 pounds.

The problem of castings size is resolving itself into physicial aspects such as the pressure necessary to place such a quantity of metal in the die, controlling rate and direction of solidification over a definite portion of the cvcle of operation, and the effective ejection of the casting from the die. The meat slicer frame illustrated in Fig. 4 is another excellent example of a die casting in the range of maximum size and weight. Contrast these castings with the spark plug cover, Fig. 1, which weighs approximately 1/64 of a pound and you get the range and variety of possibilities afforded by present die casting practice.

Drilling Operations Eliminated

The lamp base, Fig. 5, was originally designed to be sand cast in bronze. Elimination of drilling and reaming operations, economies in weight and cost of material and in the finishing influenced the engineers to change their specifications to zinc die castings. The left-hand view in the illustration shows the ribs, lugs and other stiffening elements which allowed considerable reduction in weight and wall thickness from that in the earlier design. Sharp

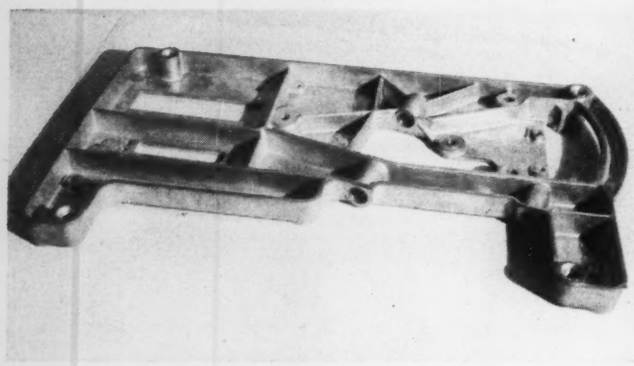


Fig. 4—Use of lugs, ribs and cores is much simplified by employment of the die casting process

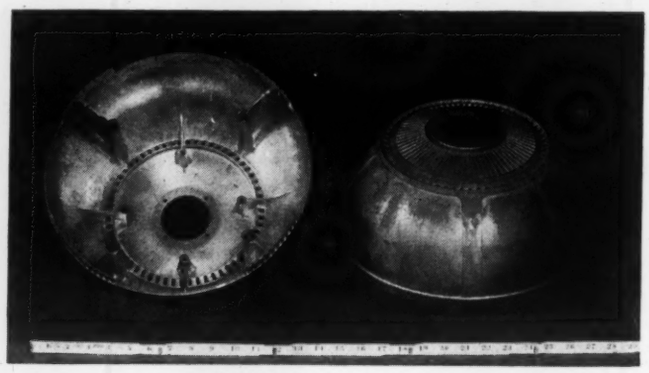


Fig. 5—Drilling and reaming operations are eliminated in this sun lamp base by casting as one unit

and exact reproduction of the decorative elements was also attained. This casting is 14 inches in diameter, 7½ inches in depth and weighs approximately 9½ pounds.

This wide variety of applications and the solutions of the attendant problems has allowed mechanical designers to effect many economies which formerly had been impossible. A single illustrated example of a small machine, Fig. 6, designed for 1933 economy and incorporating about twenty die castings should be impressive evidence of the present applicability of these alloys and the die casting process. This home canner utilizes bevel gears, a planetary gear reduction for a cam motion, levers, handles and housings all produced by die casting.

Properties of Die Cast Zinc Alloys

	Alloy 2	Alloy 3	Alloy 5	Alloy 6
Composition				
Aluminum	4.10	4.10	4.10	4.10
Copper	2.70	.....	1.00	1.25
Magnesium	0.03	0.04	0.03	.....
Balance zinc				
Impact strength (Charpy) as measured on ¼ by ¼-inch bar	15.00	18.25	17.75	18.50
Tensile strength, pounds per square inch	47,300	36,100	41,600	39,600
Elongation, per cent in two inches	8.4	4.7	4.2	10.6
Compressive strength, pounds per square inch	93,100	60,500	87,300	91,700
Brinell hardness	83	62	73	71
Specific gravity	6.754	6.644	6.675	6.717
Melting point, degrees Fahr.	733.6	727.9	726.9	731.8
Solidification shrinkage, inches per foot	0.1492	0.1380	0.1385	0.1560
Modulus of rupture, pounds per square inch	116,000	94,700	105,200	102,800
Transverse deflection, inches	0.22	0.27	0.16	0.27
Shearing strength, pounds per square inch	45,800	30,900	38,400	38,400
Specific heat, calories per gram per degree Cent.	0.1047	0.0980	0.1024	0.1036
Thermal conductivity, calories per second per cubic centimeter per degree Cent.	0.253	0.273	0.256	0.266
Thermal expansion, inches per inch per degree Cent.	0.0000277	0.0000274	0.0000274	0.0000278
Electrical conductivity, mhos per cubic centimeter at 25 degrees Cent.	114,402	155,302	150,532	151,111
[1]Relative fluidity in seconds	87 3/5	60 2/5	66 4/5	70
[2]Fluidity number	114	166	151	143

NOTE: These values are the average of several casts and were determined six months after casting date.

[1]Time required for equal volumes to flow through standard orifice at constant temperature.

[2]Derived by dividing 10,000 by time in seconds to indicate comparative fluidity.

In most cases the application of die castings allows a redesign which consolidates several parts into one and eliminates many machining and assembly operations. One of the most interesting and obvious examples of this consolidation of many small parts into one is the frame of a photoelectric exposure meter shown in Fig. 7. If the designer of this frame had not realized the applicability of die castings he would have had to resort to quite an assembly job of stampings, tubing, castings and screw machine parts; and a delicate assembly at that.

Fig. 6—About twenty die castings are used as parts for this home canner

Economies inherent in die casting design have been well known for several years. The purpose of this article has been to show the possibility of applying them to a wide variety of parts. And, such are the rapid developments in this industry, any limitations suggested here must be considered as of this date. Present research in alloys will develop physical properties needed for new applications. Die designers and die casters are solving new problems every day.

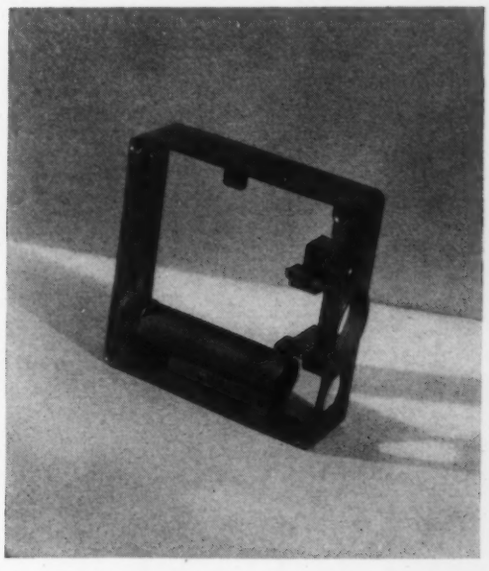


Fig. 7—Many members are consolidated in fabricating this frame

MACHINE DESIGN

L. E. JERMY, EDITOR
ALLEN F. CLARK
HAROLD B. VEITH
F. H. BURGESS

Conditions Demand Broader Interests on Part of Engineers

IN HIS recent address as retiring president of the American Society of Mechanical Engineers, A. A. Potter defined clearly the future field of broadened opportunity and greater responsibility for engineers.

"Having developed the necessary technique for almost unlimited wealth, the engineer," he said, "can no longer afford to stand aside while financiers, promoters and politicians so tragically bungle the problem of its distribution. . . . Engineering is inevitably headed toward responsibility for maintaining that balance in the social structure which modern conditions have sometimes so violently upset; also toward active participation in political affairs where clear thinking and courageous action are so badly needed."

To qualify for the important role which Dean Potter envisions, engineers must broaden the forms of their interests along the lines discussed in a series of articles on the external relationships of engineers which appeared in MACHINE DESIGN in 1931 and 1932. In those discussions, engineers were urged to co-operate more effectively in the executive, sales, production and purchasing activities of their respective companies, and in the councils of their customers, their industry and their engineering profession.

Every argument presented at that time is doubly appropriate today. The "new deal" of 1933 has accentuated the problems of social reform and turned the spotlight upon distribution.

In 1934, more than in any previous year, the following words of Dr. Albert Einstein will be an appropriate guide for engineers: "It is not enough that you should understand about applied science . . . . Concern for man himself and his fate must always form the chief interest of all technical endeavors."

• • •

Style Cannot Replace Reliability

ONE of the most outstanding examples of change in appearance of machines is that which is taking place in domestic washing machines. During the past year or so the leading manufacturers have reawakened customer interest by redesign, some of these concerns engaging design consultants to assist. Increased sales have compelled other companies to keep up with the trend, or lose business.

This tendency toward change, particularly in appearance, is receiving serious consideration in other fields. So much so that in some cases other factors such as reliability and efficiency are being subordinated to it. Progressive engineers, however, are alive to this and are taking extra precautions to prevent customer eye appeal from cutting too deeply into appeal from the standpoint of mechanical performance.

MEN and Their MACHINES

ROBERT R. HARKINS AND THE CENTRIFUGAL HOT OIL PUMP

Men and Their Machines

CLOSE friends of Robert R. Harkins reveal that he is the type of engineer who rolls out of bed in the middle of the night to record an idea that happened to flash through his mind during a wakeful moment. To him the drawing board (one stands beside his bed) during such interludes holds no grim realities of the workday ahead. Sleep loses its appeal when he finds an opportunity to contribute another factor to the development of the centrifugal hot oil pump.

Hydraulics fascinates Mr. Harkins; this subject is both his vocation and avocation. He also has the happy faculty of combining the theoretical with the practical and is never satisfied with his mathematical calculations until the test data sheets on an impeller, for instance, presents favorable results. In the early days of his engineering career he taught mathematics at Purdue university. That was after his graduation in mechanical engineering from Ohio State university in 1900. During this period he cultivated a thorough background in pure science.

Then came his practical experience; first with the Atlas Engine Co., Indianapolis, in the design of Corliss engines. There he was given the opportunity to put his theoretical knowledge to work. From the drawing board he studied the problems of the shop, later going into sales. With the Gould Pump Co. he learned the needs of the field and was able to interpret them on paper to aid the engineering department. When Harmain Engineers Inc., Upper Sandusky, O., was organized to build centrifugal hot oil pumps he was made vice president in charge of engineering.

To sit down and discuss engineering development with Mr. Harkins is a rare treat. His philosophy discloses a genuinely wholesome character. Regarding his work on design of centrifugal pumps he is extremely modest and frankly admits that the completed machine is as much the efforts of his engineering associates as his own. He does not believe in one-man organizations—engineering achievement is a symphony rather than a solo affair.

Logic governs his decisions now just as it did when he graduated from high school in Columbus, O., where he was born, Jan. 1, 1880. He went to college because he considered that he could always go to work but not always to college. He picked mechanical engineering as his profession because it embodied several phases and always offered the shop as a safety factor for employment. And that type of reasoning is perhaps the secret of his successful record as a designing engineer in the pump industry today.

Refinery Equipment

PROFESSIONAL VIEWPOINTS

Machine Design Welcomes Letters Suitable for Publication

Determining Patent Procedure

To the Editor:

REFERRING to your issue of November, 1933, and the article "Protect Your Rights to a Valid Patent," by George V. Woodling, we are particularly interested in two factors effecting the loss of the right to a valid patent due to unpublished or published knowledge more than two years prior to the application for patent.

We have in mind some patents which were used by the inventor, on public use, for five or six years prior to the application for patent, and are wondering what procedure would be necessary to invalidate these patents. It might be just as well to let the owner of the patent bring suit and make a test case. We thought, however, if this knowledge was presented to the patent office, with proper proof, the patents might possibly be recalled without any great expense.

—MACHINERY MANUFACTURER

To the Editor:

THE inquiry which you received from "Machinery Manufacturer" is a most interesting one, and it outlines a situation that many manufacturers must face. The solution rests with the choice of the manufacturer, a choice that should be made only on advice of a patent attorney.

All questions relating to the invalidity of a patent are determined by the Federal Courts. When a patent is once granted by the Patent office it is prima facie valid and the Commissioner of Patents has no power to cancel the patent. Therefore, by reason of the fact that a patent is prima facie valid, the patentee may bring suit in a Federal Court to enjoin all infringers thereof. However, as a good defense to such suit, the defendant may prove that the patent is invalid in view of the fact that the patented device has been in public use for more than two years prior to the application for the patent. To constitute a good defense it is necessary for the court to find that the devices which were in public use for more than two years are substantially identical to the patented device.

As a practical proposition this manufacturer may do either one of two things. First: The company may manufacture and sell such patented devices and let the plaintiff bring suit thereon. This, however, may not be advisable until after consultation with a patent attorney.

Second: If the patentee is a friendly competitor the company may effect some working or license agreement with the patentee, which would involve much less expense than defending a patent lawsuit, this usually involving a large sum of money and possibly being prolonged indefinitely before it is finally decided.

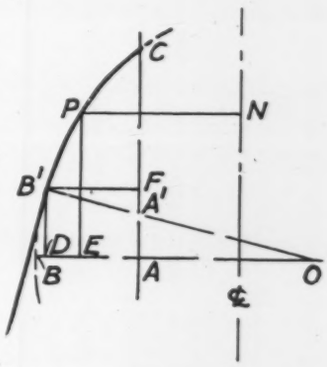
—GEORGE V. WOODLING,
Cleveland

Shortening Design Labor

To the Editor:

PRACTICALLY all designers are interested in the shortening of design labor that sometimes can be effected by stepping off the beaten path. Such a saving apparently was obtained in the design of a double-cambered boom where parabolic arcs were substituted for the circular arcs that more or less naturally suggest themselves. However, it must be considered that as circular arcs have been suggesting themselves to our forebears, they have been worked out for us. The results are ready for use, barring only one or two simple slide rule calculations.

Results for problems using circular arcs have been already worked out by earlier designers



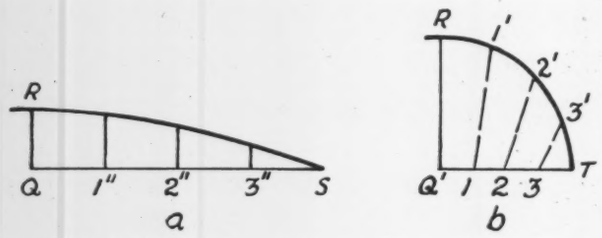
Taking a design problem like the double-cambered boom, in the first illustration, let the circular arc *CB'B* be the desired curve, the boom either terminating at *C*, or joining tangentially

a reverse curve at that point, or (a decidedly unusual design) continuing past C in a straight line. The center of the camber arc is at O, radius OB' being normal to the straight side of the boom, and radius OB being normal to the center line of the boom. Now the diameter of the circle, of which the camber curve is an arc, is

$$20B = AB + (AC)^2/AB$$

Since angle $B'OB$ is the taper angle of the boom, and since $B'F$ and CF are physical quantities, AB and AC are readily determined. For any point P on the arc, height PE from OB, the distance $2NP$ may be taken from handbook tables (Marks', second edition, p. 35; Kent's, tenth edition, p. 76) in terms of ratio, whence the tie bar length, or rivet hole location, or whatever else may be desired, by the slide rule route.

A graphical solution for the same problem is



For barrel-tapered booms the camber becomes a conoid of revolution as shown

given in the second illustration. This solution works out quite satisfactorily if a reasonably large scale is used. Incidentally, this method is a favorite among shipbuilders for laying out the camber for deck beams as well as for booms. In a large ship, where a thousand or more beams will be formed to the same layout, not to mention the determination of the lengths of supporting columns, of scewness, of brackets, girder angles and the like, a method that will quickly yield satisfactory results is naturally of highest importance. For "barrel tapered" booms and masts, whether of tubular steel or of wood, the camber becomes a conoid of revolution of the curve shown at A in the second illustration.

Equal Sections Used

In A, QR is the height of the camber, and QS is the half-chord of the camber arc. In B, radius $Q'R'$ represents the camber height to a larger scale. Divide $Q'T$ into any number of equal parts, $Q'1$, 12, 23; and arc $R'T$ into the same number of equal parts, $R'1'$, $1'2'$, $2'3'$. Divide QS in the same manner into parts $Q1''$, $1''2''$, $2''3''$, and along the perpendiculars erected through these division points lay off distances $11'$, $22'$, $33'$, and "draw a fair curve," AS.

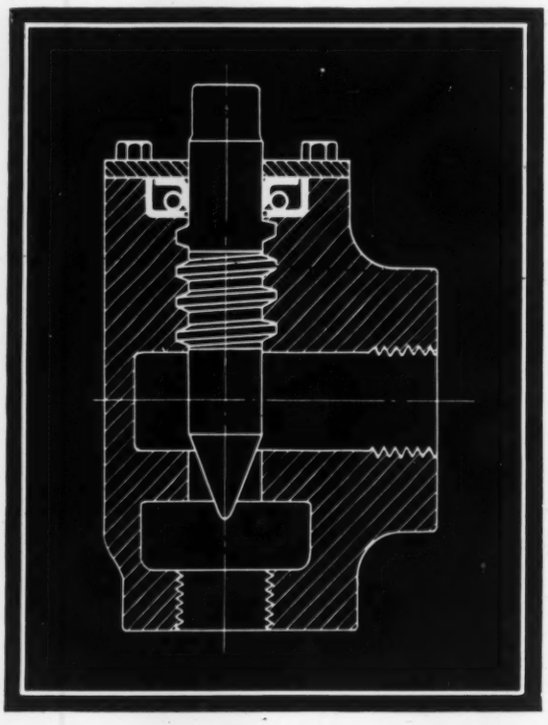
This method makes it easy to foreshorten the camber curve. If, for example, a longitudinal scale (the scale for OS in A) of one inch to the foot is used, and the transverse scale is 3 inches to the foot, transverse dimensions can be scaled off to the nearest sixteenth inch without difficulty, and the diagonals can be calculated from right-angled triangles.

—JOHN FLODIN,
Brooklyn, N. Y.

Utilizing the Standard Oil Seal

To the Editor:

THE interesting, though unconventional, application of unit oil seals described in the November issue of MACHINE DESIGN has prompted me to submit another unconventional use for such a seal. As shown in the accompanying illustration, the seal was used on a gas regulating valve working at about twenty pounds pressure. Compactness is the chief advantage of the seal as with its use the stem may be much shorter than with a conventional stuffing box. An oil seal was used in preference to a



Packing for gas regulator valve is characterized by its compactness

simple hat leather because it is standardized and because it is provided with a spring to keep the leather in contact with the stem when the pressure is off. Thus it is always ready for service.

—ENGINEER,
Washington

TOPICS

Increased Industrial Use of Nickel Raises 1933 Consumption

WORLD consumption of nickel in all forms for the first ten months of 1933 was 77,609,280 pounds as compared with slightly more than 49,500,000 pounds in the same period of 1932. In the corresponding part of the peak year of 1929, production amounted to 112,481,600 pounds. To some degree the recent increased consumption was due to prior liquidation of nickel steel scrap, necessitating the use of new nickel in furnace operations; but an important reason for the improvement has been the increased industrial activity stimulated by the N. R. A. in the United States which consumes more than half of Canada's production of nickel. Deliveries to countries other than America show correspondingly favorable increases over 1932.

* * *

Decentralization of Industry Again Is Topic of Discussion

SHIFTING of industry through decentralization from the congested city areas to suburban and rural regions seems likely to be accompanied by some reduction in the sizes of such establishments. This is the opinion of the committee on decentralization of industry of the business advisory and planning council of the department of commerce. It may be recalled that Virgil Jordan also holds this opinion, as expressed at the recent meeting of the A. S. M. E.

Chairman W. A. Julian of the department of commerce committee, speaking before the national research council, declared his group is not just another committee "but one composed of business men who are aware of losses incurred by waste and depleted resources "just because we have failed in the past to give adequate consideration to shifts which are taking place in the location of industry and population." Among other things the committee is trying to determine whether decentralization of industry is socially and economically desirable. Mr. Jordan's statement is particularly significant: The energies of economic growth will be withdrawn gradually from their great creations—the industrial dinosaurs and commercial mammoths—of the past and make a fresh start in a small way in many scattered individuals.

* * *

C.W.A. Projects Give Employment to the "White Collar" Class

FAR reaching effects of C. W. A. projects to alleviate unemployment undoubtedly will give some assistance to mechanical engineers who have not been able to find work. Although the tasks which they might be called upon to perform may not be precisely in line with former duties, being more closely related to civil engineering, there is a likelihood that their training will stand them in good stead in seeking positions. The first objective of the plan is to afford work for a large number of unemployed professional and technical men embraced in the "white collar" class throughout the country. It is hoped that new projects will be sponsored shortly that will fall clearly in line with the qualifications of mechanical engineers.

* * *

Contest Yields Suggestions for New Markets in Steel Industry

FORTY judges selected to choose the best suggestion offered for the stimulation of the steel trade united recently to award first prize to Barton R. Shover, Pittsburgh consulting engineer. His suggestion was the manufacture of

(*Concluded on Page* 48)

MEN OF MACHINES

THE record of Harold T. Youngren in automotive engineering is impressive. It embodies a diversified series of connections with different organizations. His new appointment as chief engineer of the Olds Motor division of General Motors Corp. is another step in his career. The fact that he has been a member of the Society of Automotive Engineers for 22 years bears witness of his professional interest in this field.

Mr. Youngren was born in Oakland, Calif., May 1, 1892. Most of his boyhood and school days were spent in Milwaukee where he was graduated from high school in 1910. Subsequently he became a draftsman for Allis-Chalmers Mfg. Co. Then for several years he was with the Westinghouse engineering staff, Falls Motor Co. and Harley-Davidson Motor Co., respectively. In 1917 he was employed by the Curtiss Aeroplane & Motor Corp. at Buffalo and Garden City, L. I., as an experimental designing engineer, and after the war was engaged on design work for the Fergus Car in Newark, N. J. Later he spent a short time in engineering development of the Houdaille shock absorber. Pierce-Arrow Motor Car Co. obtained his services for chassis and motor design in 1920.

In January, 1927, Mr. Youngren joined Studebaker Corp. From that organization he went to Buick as assistant chief engineer, until his present promotion.

HAROLD T. YOUNGREN

• • •

JAMES A. HALL

BY HIS unrelenting energy and interest in machine design activities Prof. James A. Hall has become one of the prominent figures of the profession. He now holds the office of manager of the American Society of Mechanical engineers and is professor of mechanical engineering at Brown university. A native of Berlin, Vt., he was born in 1888, and attended the public schools of Providence, R. I. Later he entered Brown university, graduating in 1908 with an A.B. degree. The degree of bachelor of science in mechanical engineering was conferred upon him in 1910 by the same institution where he remained as assistant and then instructor in mechanical engineering until 1914.

Subsequently he became connected with the engineering department of the Link-Belt Co. at Philadelphia, but the following year returned to Brown university as assistant professor of mechanical engineering. Prof. Hall became associate professor in 1920 and since 1925 has been professor of mechanical engineering. He also is a consulting engineer with Brown & Sharpe Mfg. Co.

His work in the American Society of Mechanical engineers which he joined in 1912, has been noteworthy. In addition to his present office as manager he holds the chairmanship of the new machine design division.

IN HIS new capacity as general manager of the Harris-Seybold-Potter Co., Cleveland, Norman L. Daney has a wealth of engineering experience to guide him. His early record includes a degree in mechanical engineering obtained from Ohio State university in 1905.

Elyria, O., is his birthplace, and in that city he also attended high school, graduating in 1901. From 1905 to 1908 he was employed by the Dean Electric Co. there and served as an instructor in mechanical engineering for the International Correspondence school, Scranton, Pa. Three years thereafter he worked for the National Tube Co. as mechanical engineer and in 1913 became associated with the Chapman Engineering Co.

For 18 years Mr. Daney was identified with the C. & G. Cooper Co., engine builders, and owners of the Chapman company. Concurrently with his activities in the Cooper organizatiou which in 1929 became the Cooper-Bessemer Co., he acted as treasurer and general manager of the Chapman unit, and treasurer and general manager of Chapman-Stein Furnace Co., another subsidiary. Mr. Daney joined Harris-Seybold-Potter company in 1931, serving first as assistant treasurer, then treasurer and now as general manager of the organization.

NORMAN L. DANEY

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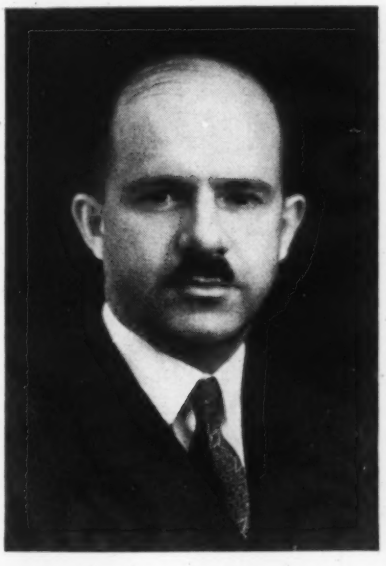

A. R. STEVENSON JR.

CHOICE of Alexander R. Stevenson Jr. to head the American Society of Refrigerating Engineers brings into the public eye a man of many qualifications. He has an enthusiasm for things new and electricity which keeps him always the personification of eager and searching youthfulness. General Electric lists him as one of a triumvirate—Chester Rice and P. L. Alger are the others—that is formidable in accomplishments of an engineering nature. These three might be said to have the official task of starting things moving, in their capacity as assistants to the vice president in charge of engineering.

Curiously enough, Mr. Stevenson is a native of Schenectady, having been born there in 1893. He was graduated from Princeton in 1915 and returned to Schenectady to obtain his M.S and Ph. D. degrees from Union in 1915 and 1917 respectively. Subsequently he joined General Electric. Shortly thereafter he went into World war service. When he returned from France in 1919 he again took up his duties with the company and in 1923 became a member of the engineering general department.

Refrigeration with its new problems was one of his first and principal fields of investigation. He has written several reports on oil heating and air conditioning and has done much preliminary work along these lines.

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JOHN VAN NOSTRAND DORR, president of Dorr Co., Inc., has been named to head the newly organized Chemical Engineering Equipment institute.

* * *

B. F. HARRIS, president of the Oil Well Supply Co., has been made president of the National Tube Co. to succeed FRED W. WATERMAN. Mr. Harris began his career in 1902 in the engineering department of American Sheet Steel Co., now the American Sheet & Tin Plate Co. Mr. Waterman retired on January 1 under the pension plan of the Steel Corp.

* * *

HARRY W. MCQUAID has joined the metallurgical staff of Republic Steel Corp., Youngstown,

O. He will devote his time to research and development work.

* * *

COMMANDER T. G. W. SETTLE'S recent stratosphere flight, has been recognized by the Federation Aeronautique Internationale as having set a world's record for altitude.

* * *

T. H. DOAN has been elected president of Foote-Burt Co., Cleveland, to fill the unexpired term of the late GEORGE E. RANDLES.

* * *

AMBROSE SWASEY, chairman of the board, Warner & Swasey Co., Cleveland, recently was awarded the 1933 medal of the American Society of Mechanical Engineers for his part in the advancement of the turret lathe and astronomical telescope.

* * *

HOWARD COONLEY has been re-elected president of the American Standards association for 1934. He is president of the Walworth Co., New York. F. E. MOSKOVICS, chairman of the board, Marmon-Herrington Co., Indianapolis, was re-elected to the vice presidency of the standards organization.

* * *

ADDIS E. MCKINSTRY has been elected president of International Harvester Co, Chicago, succeeding the late ALEXANDER LEGGE. In 1930 he was president of National Association of Farm Equipment Manufacturers, now the Farm Equipment institute.

* * *

J. C. IRWIN, representing the American Railway association, and F. M. FARMER, representing the American Society for Testing Materials, recently were elected to the chairmanship and vice-chairmanship, respectively, of the Standards Council of the American Standards association, the body in charge of the development of technical standards.

* * *

T. J. LITLE has been retained as engineering counsel on electric cast iron in the automotive industry by the Detroit Electric Furnace Co., Detroit. He formerly was an engineering executive at both the Lincoln and Marmon motor car companies, and is past president of the Society of Automotive Engineers (M.D., Nov., 1929).

* * *

FRED R. ERBACH, formerly chief engineer of General Refrigeration Co., Beloit, Wis., recently was appointed vice president and general manager. He entered the refrigeration industry in 1923, and prior to joining the Beloit organization was assistant chief engineer, Kelvinator Corp., Detroit.

* * *

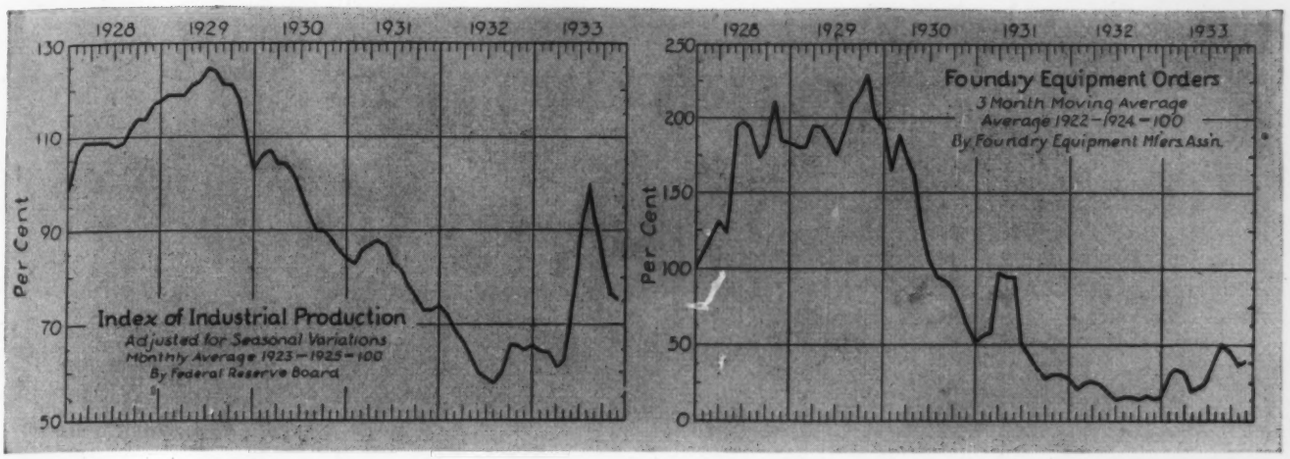
ORVILLE WRIGHT and his deceased brother WILBUR were honored at a recent Washington celebration marking the thirtieth anniversary of the first flight in a heavier-than-air machine.

Obituaries

TILLMAN D. LYNCH, former Westinghouse consulting engineer, died recently at Edgewood, Pa. He was 66 years old. Mr. Lynch who had retired from active duties was one of the best known metallurgical engineers of the United States, a past president of the American Society of Steel Treating and of the American Society for Testing Materials. Born in Harrison County, W. Va., in 1867, he graduated in 1891 from Virginia university. Subsequently he joined the engineering firm of G. W. G. Ferris & Co. From 1897 to 1899, the period of the Spanish War, he was in the Bureau of Steam Engineers, United States navy, joining the Westinghouse company in 1899.

* * *

THOMAS J. BRAY, director and member of the executive committee of the Youngstown Sheet & Tube Co., Youngstown, died recently. Since his graduation in 1894 from Lehigh university he has been identified continuously with engineering companies. He was born in Pittsburgh. Early in his career he was chief draftsman of the Lewis Foundry & Machine Co. In 1901 he was made chief engineer of the United Engineering & Foundry Co., Pittsburgh, and from 1911 to 1928 was president of Republic Iron & Steel Co.

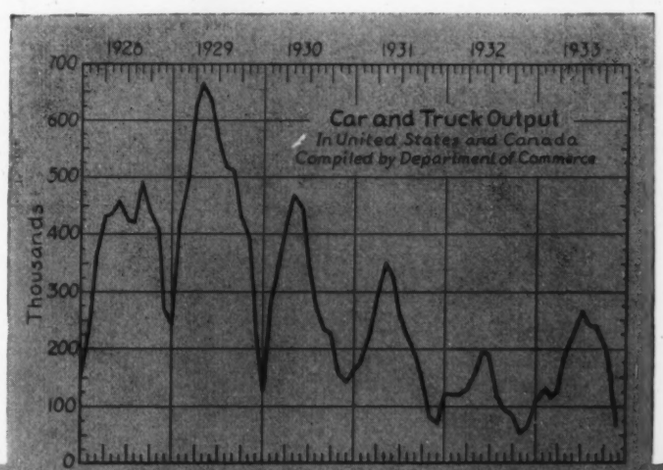


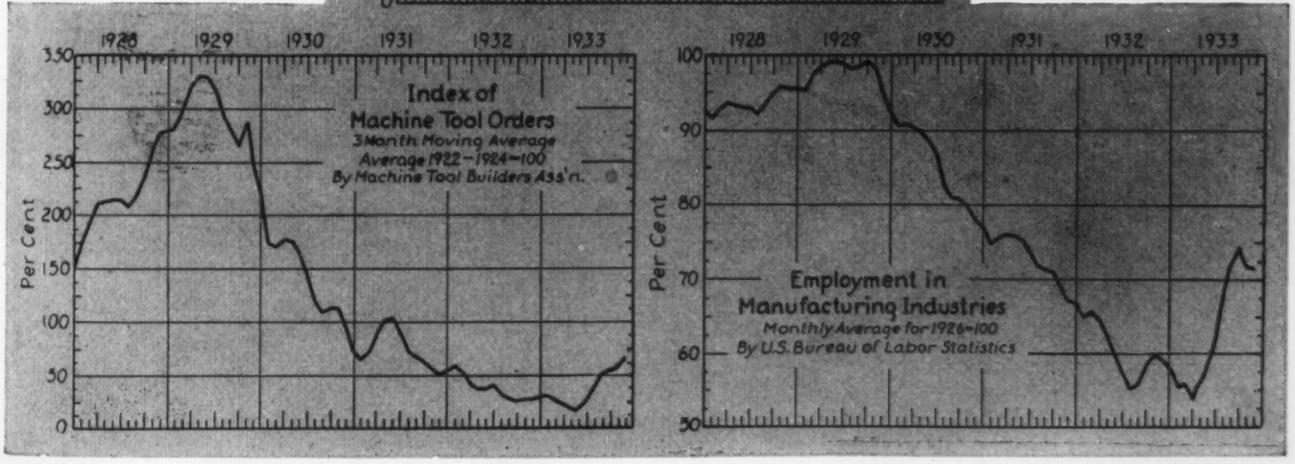
How Is Business?

THIS is the open season for predictions! Prognosticators all over the country are investigating charts, trends, indexes to arrive at a fairly reliable estimate of the business that may be expected during 1934.

Not all of the predictions hold out hopes for increased business next year. However, tell those Christmas shoppers who weathered the storm, or tired clerks who worked with six others in a behind-counter space planned for two and still could not keep up with the demands, that business will not be improved in the near future and they will merely chorus "Oh Yeah!"

The personal buying habits of the country give an amazingly accurate indication of future possibilities, and these buying habits have revealed a new and altogether encouraging psychology. Not only was the volume of Christmas sales far above the past few years, but luxury-gift buying made an astonishing comeback. The country is in a buying mood. Machine manufacturers are certain to secure both direct and indirect benefits. The changed psychology has already aided automobile manufacturers who are overlooking no opportunity to gather in all available prospects. When the usually ultra-conservative Henry Ford introduces a most aggressive promotional program, it is evidence that the sales are there.





NOTEWORTHY PATENTS

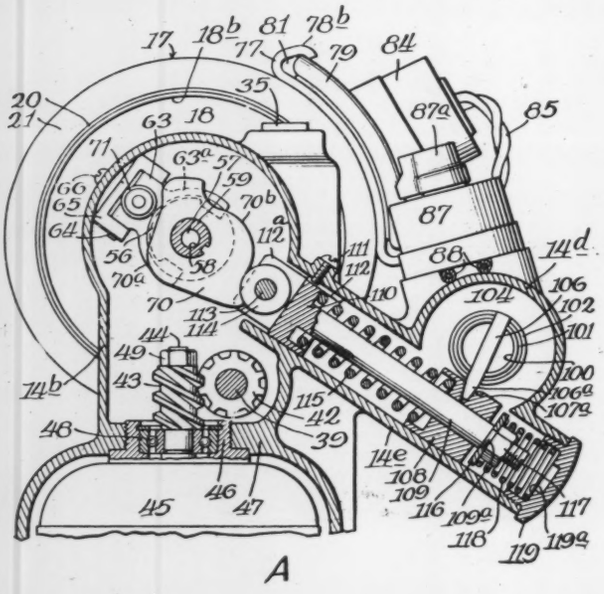
IN A portable ironing machine recently patented, there have been incorporated a unique method of rotating the roll, and also a mechanism for effecting relative movement of the ironing shoe and the roll. The invention was conceived by J. T. Hume for Electric Household Utilities Corp., Chicago. As shown at *B*, Fig. 1, which is a cross section of the roll driving shaft 50, roll driving gear 32 runs continuously while the circuit to electric motor 45 (*A*, Fig. 1) remains closed.

To control the operation of the roll driving shaft 30 (*B*) by gear 32, the clutch mechanism embodies an inner clutch 50 which is secured to the end of shaft 30 by a pin 51. This member has longitudinal teeth that form a sliding driving engagement with similar teeth on outer sleeve 52. The sleeve is provided at one end with an annular series of teeth 53 that mesh with the teeth of member 54 secured to the face of gear 32. When clutch member 52 is in inner position, clutch teeth 53 and 54 are in engagement and connection thus is established between gear 32 and driving shaft 30.

Outer end of clutch member 52 is secured to circular plate 56 having its center attached to a plunger 57 which extends into bore 58 of shaft 59. Coil spring 61 is mounted in the bore 58 and serves normally to force plunger 57 toward the left, thereby tending normally to cause clutch teeth 53 to engage clutch member 54. Movement of clutch member 52 to disengaged position (*B*) is effected by means of a bellcrank lever 63 which is pivoted at 64. Depression of arm 63^b of the bellcrank lever is brought about by engagement of cam 70 with roller 71. Operating handle 73 slides in a bore in enlarged head 59^a. Cam 70 is keyed on shaft 59. Handle 73 is held in desired position by means of a ball 74 which is pressed by coil spring 75 to engage one of the annular grooves 73^a formed in the handle.

When handle 73 is turned to a position wherein cam 70 disengages clutch 52, thereby arresting rotation of ironing roll 17 (*A*), the ironing shoe 77 simultaneously is disengaged from the roll. Burning of the clothes or the roll is prevented thereby, due to the fact that block 108 and plunger 109 are forced upwardly and toward the left by the action of coil spring 118.

Cam surface 70^b is of such shape that it causes movement of the shoe as cam roller 114 passes along the cam surface from engagement with one extremity to the depression at the other side. A single cam operated by one arm or lever thus is employed for controlling the engagement and disengagement of the clutch which actuates



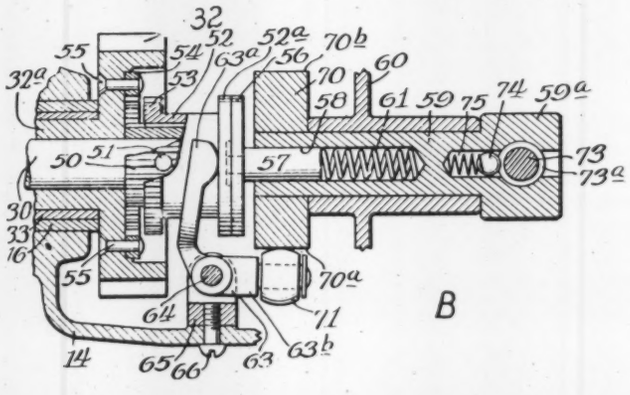


Fig. 1—Shoe and roll of ironing machine operate together to prevent burning of clothes or roll

the roll, and also for controlling the movement of the ironing shoe toward and from the roll. By this means the separation of the shoe and roll is insured when the ironing roll is not being rotated through the clutch by the driving motor.

The patent is registered as No. 1,937,572.

FEATURES have been incorporated in the rear assembly of a riveting hammer to minimize wear, obviate clatter, reduce the number of parts and utilize the cushioning action of buffers effectively. These improvements have been patented by High Speed Hammer Co., Inc., Rochester, N. Y., through Edwin F. Meyering. Fig. 2 shows the revised design. In previous models the rear cushions were held in assembly by two separate rubber retainers and a wrist pin interposed between them. Through these retainers and wrist pin the entire assembly was held by a connecting rod. This allowed excessive floating effect of retainers and wrist pin, resulting in a tendency of the pin to come into contact with the connecting rod and cause wear.

The new improvements consist of a center rubber retainer 15 which is provided with upper

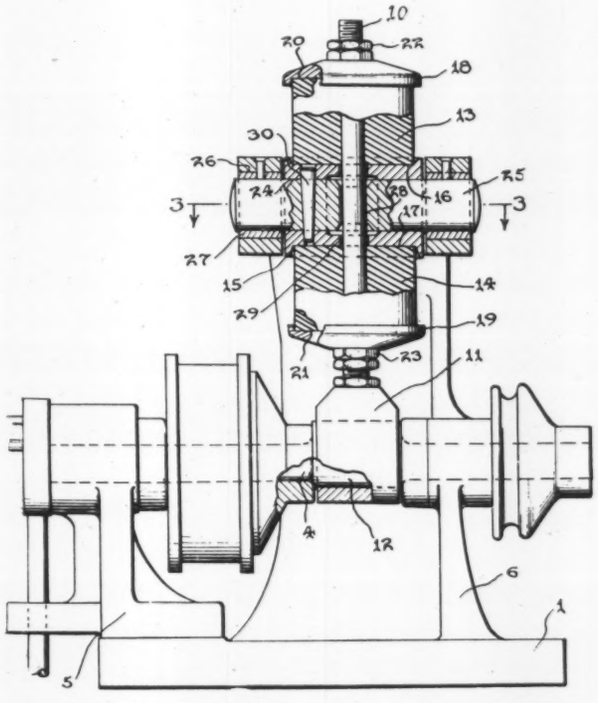


Fig. 2—One-piece rubber retainer utilizes cushioning action of buffers without permitting wear

and lower seats 16 and 17 in which the buffers 13 and 14 are held. This retainer is made in one piece, doweled by pin 30 extending through wrist pin 25. Floating of the wrist pin in the rubber retainer is eliminated, these two parts being held in constant relative position. Any other floating effect is confined to bearings 26 of the vibrator. Thus the buffers or cushions associated with the helve of the hammer and the pitman are separated by the one piece retainer to which the wrist pin is connected rigidly. No. 1,927,096 is assigned to the patent.

EXCESSIVE impact when the film gate is closed after threading film through a motion picture projector is prevented by a new control. The device, recently granted a patent, was designed by L. S. Frappier and Ewald Boecking for International Projector Corp., New York. Pneumatic means are employed for cushioning

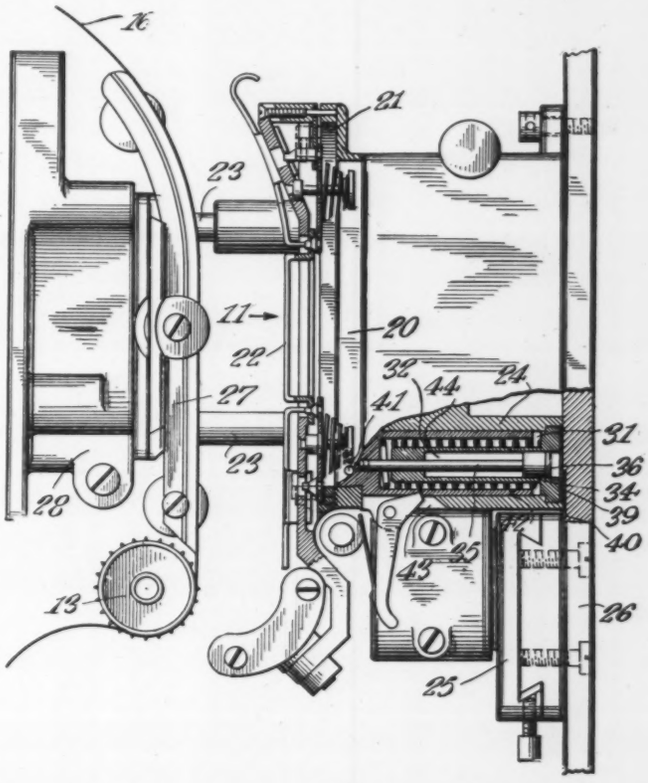


Fig. 3—Pneumatic device cushions gate-closing action of motion picture projector

the closing action of the gate and for counteracting the force of the closing spring.

When the gate assembly 11, shown open, is moved to closed position against film 16, piston 34 depicted in Fig. 3, compresses air in cylinder 32. The compressed air retards the closing action of sliding member 20 to which is secured frame 21 carrying pressure shoes 22 that contact the edges of the film 16. This retarded action is effective until port 42 reaches space 43. Air pressure then is released and the gate is allowed to close completely. The full force of closing spring 44 then is exerted upon the gate to maintain it in position. When the gate is again opened the back pressure of piston 34 causes movement of flap 39 whereby port 40 is opened and the air allowed to escape. No. 1,913,390 identifies the patent.

Topics of the Month

(*Concluded from Page* 41)

bathrooms from steel on a production scale. The Association of Iron and Steel Electrical Engineers conceived the contest in an effort to bring out new uses for steel. Second prize went to M. Appel, draftsman, Ohio Works, Carnegie Steel Co., Youngstown, O., on his suggestion for wider uses of decorated steel tile. S. Ein, testing engineer, Illinois Steel Co., South Chicago, Ill., took third prize with his proposal to make telephone booths from steel plates, supplanting wood from which they now are built.

Carrying out of these suggestions ultimately would result in the development of new machinery for fabrication of the steel structures. This already has happened in the case of the steel house.

* * *

Easier Credit Is Seen as Solution to Machinery Replacement

FROZEN industrial loans will be liquidated more quickly if bankers extend borrowers additional credit for the purchase of modern equipment and machinery, declares P. E. Bliss, president, Warner & Swasey Co., Cleveland. In particular he cites the case of a company in which machine tools used for one important operation are obsolete. Replacement by new and more efficient machines would cost $75,000. The savings effected in operating costs would amount approximately to $42,000 a year. The machine tools therefore would pay for themselves in a little over 18 months.

* * *

Machinery Has Important Place in Chemical Industries Show

MACHINERY or process equipment ranked with raw materials and finished products as one of the three divisions of the fourteenth exposition of Chemical Industries held recently in New York. This type of equipment includes the units that carry out various treating and handling operations to which materials of many industries are subjected. One of the fascinating exhibits was the machinery used in handling ores. Incentive for this equipment whose units are known as thickeners, agitators, classifiers and clarifiers, goes back to the time when the originator was a mining engineer and felt the necessity of ingenuity even in rudimentary prospecting and mining operations. Applications have been extended to include processing of chemicals, paper mill operations, sewage and water treatment, and the cement and gravel industries.

* * *

Potential Uses for Cathode Ray Tubes Include Television

THE cathode ray tube, not so long ago a laboratory curiosity, is finding increased utility. One company reports that its research and engineering activities have been mainly along the line of producing a satisfactory vacuum type cathode ray tube in contrast to the usual gaseous type. The cathode ray field holds many potential opportunities, of which television, ultimately made practical by means of electrical rather than mechanical scanning, is but one promising outlet. In electrical, industrial and laboratory work the cathode ray tube is being used particularly in the study of wave forms and in delicate measurement of electrical energy.

* * *

Aviation Progress Points to Use of Load-Carrying Autogiros

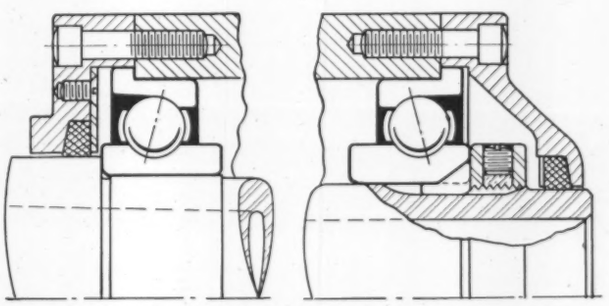
DESIGNERS now are beginning to think definitely about large load-carrying autogiros, writes Reginald M. Cleveland in the *New York Times*. While Cierva continues to improve the flying characteristics of his latest wingless model in England, attention is being given in this country to the possibilities of this type of craft for transport use.

A new engine also is mentioned by Mr. Cleveland that may exert an important influence on the future of aircraft design and operation. It is being tested in Great Britain. For seven years the experimental staff of the Bristol company has worked on the many difficult problems involved in securing trouble-free, efficient running of a single cylinder sleeve-valved unit. According to reports the engine delivers a higher horsepower output than has yet been recorded for an aircooled overhead poppet-valve motor of similar type, and with lower consumption of fuel and oil.

NEW MATERIALS AND PARTS

Ball Bearings Have Special Flanges

PRECISION ball bearings, flanged for use on spindles, have been added to the line of bearings manufactured by New Departure Mfg. Co., Bristol, Conn. The shoulders are on the bearing instead of in the housing, as shown in the accompanying illustration; thus it is possible to bore housings straight through at one set-up, thereby assuring alignment. Also, the bearings are separable for quick assembly, inner rings are extra wide to assume firm seating and are



Shoulders are on the bearing instead of in the housing in new spindle bearing

key-slotted so that they may be locked to prevent creeping about the shaft. Preload is applied through the inner rings.

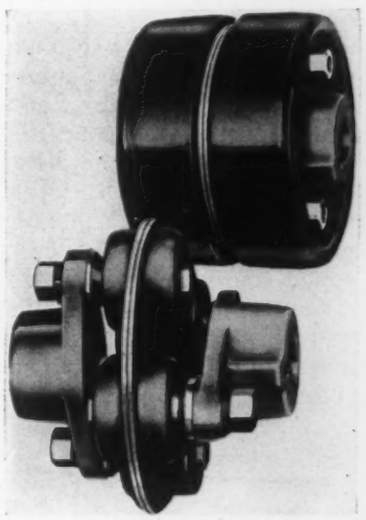
These bearings are supplied in sizes from 30 to 130 mm. bore, to precision specifications, and are obtainable in two bore sizes for each standard outside diameter.

Alloy Cast Iron Is Announced

NICKEL-CHROMIUM cast iron, martensitic in structure with a refined carbide network which contributes to a uniformly higher hardness, strength and toughness is now being offered by Robins Conveying Belt Co., 15 Park Row, New York. The material, known as Super Manga Iron, consists of a properly adjusted base mixture to which nickel (usually about 4.5 per cent) and chromium (usually about 1.5 per cent) are added in such balanced proportions as will give the best results for the intended application. Chilled surface will show a brinell hardness of 600-750. Chill depth can be controlled within close limits and a tough gray back provided if desired.

Coupling Employs Special Rubber

A NEW and improved flexible coupling which employs an unusual and especially developed rubber as the flexing medium has been introduced by Morse Chain Co., Ithaca, N. Y., a division of Borg-Warner Corp. The flexing member of the coupling, shown herewith, is a complete unit comprising four molded non-cold-flow trunnion blocks of special design spaced 90 degrees apart and set, under pressure,



There is no metal contact between the flanges in recently introduced coupling which employs rubber as its flexing member

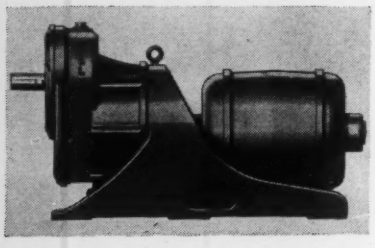
into a two-piece riveted steel housing. The rubber trunnion blocks are provided with steel cores or bushings also set under pressure into the blocks. Two diametrically opposite blocks are bolted respectively to the armed steel driv-

ing and driven flanges which are mounted on the shafts to be connected.

There is no metal contact between the flanges, the only contact between the shafts being through the flexible rubber bushings or blocks. No movement takes place between rubber and metal, all flexing being entirely within the rubber. Shocks and uneven impulses are absorbed and sudden reversal can take place without damage. The Morflex coupling needs no protection from atmospheric conditions, water, oil, dirt or grit, and requires no lubrication.

Introduces Improved Motor Reducer

COMBINING the essential features of the geared-head and the all-motor type of Motoreducer, the type LU Motoreducer manufactured by Falk Corp., Milwaukee, is a single-reduction unit which allows the use of a completely standard horizontal motor with feet, the motor being carried by a ledge-shaped casting to which the gearcase is rigidly attached. The general design of the gearing is as in the geared-head type manufactured by the company except that two bearings are provided for the high speed shaft which is connected to the motor shaft through a resilient coupling, and the high speed oil seal is modified to suit the need.

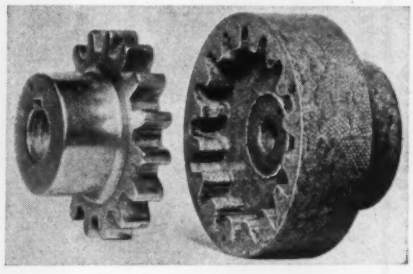


Motorized reduction unit is particularly adaptable to small engine drives

The take-off shaft may be located above or to either side of the motor shaft as desired. Where totally enclosed or explosion proof motors are used, requiring a speed reduction of 9 or less or a speed increase up to 2.3, this type is particularly suitable. It is especially adapted to small engine drives, the common mounting being equally advantageous for such prime movers as for an electric motor.

Composition Material Used in Coupling

MOLDED of macerated Celoron, a material not affected by hot or cold, oil, water, gasoline and many acids, the female end of the new patented Celoron sprocket type coupling, designed by Continental Diamond Fibre Co., Bridgeport, Pa., insures an equal distribution of the load. There are no distinct points of wear on the part, shown herewith. The material used is also a good electrical insulator. A motor equipped with the female half of the coupling is therefore completely insulated from the unit which it drives.

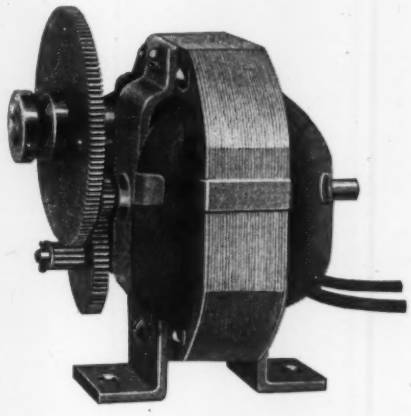


There are no distinct points of wear in design of coupling which employs composition material

There are seven standard types of couplings, each one of which is designed to cover a wide range of horsepowers. No. 1 coupling, for example, can be used on from ½ to 4 horsepower drives at speeds from 100 to 6500 revolutions per minute, while No. 7 can be used on drives from 20 to 85 horsepower at speeds from 100 to 2500 revolutions per minute.

Small Motors Are Announced

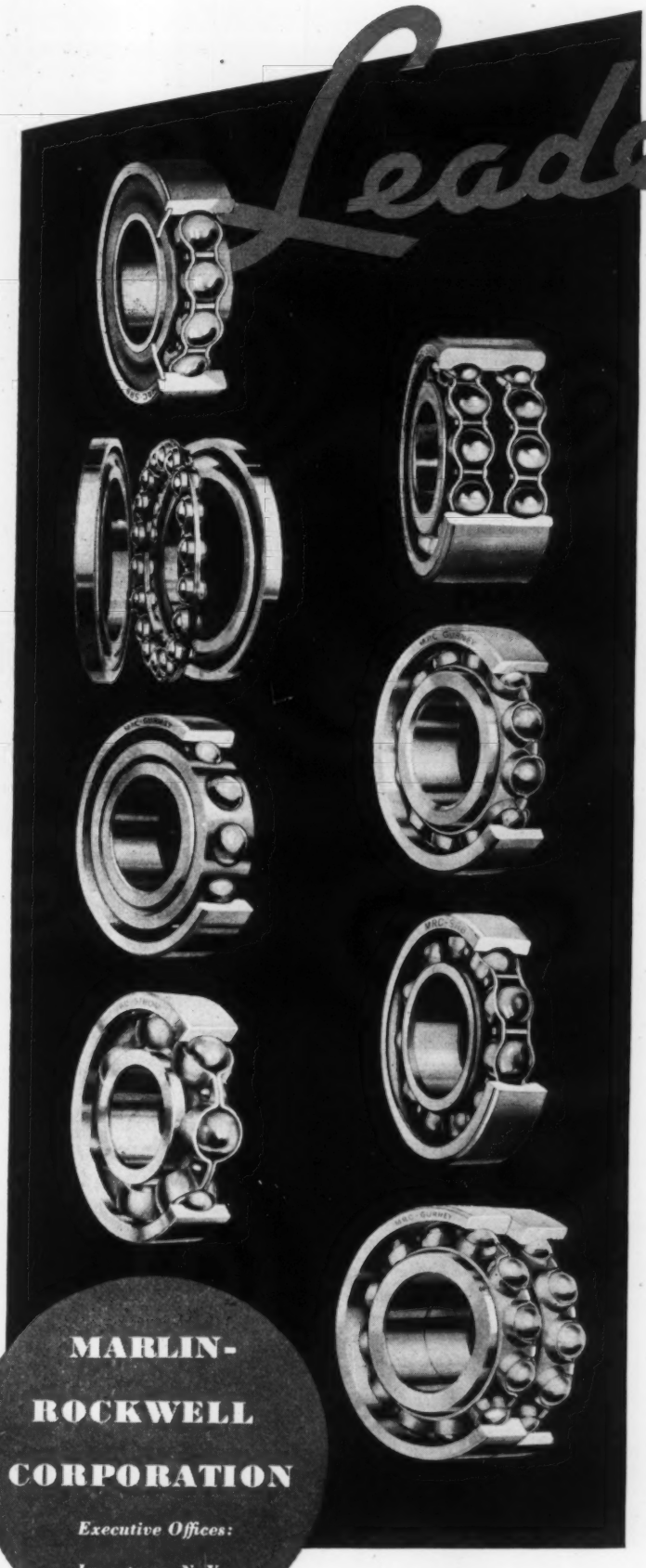
SMALL two-pole motors with center drive construction have been added to the line of fractional horsepower motors manufactured by Signal Electric Mfg. Co., Menominee, Mich. These motors, shown herewith and known as type PM, are of the single phase, induction, shaded coil type that is adaptable for applications such as small tools, display signs, etc., where little power and starting torque are required.



Easy mounting is provided for by construction of small two-pole motors

For use on alternating current only, this motor

Leadership



MANY TYPES— BUT *one* RESPONSIBILITY

Twenty-three different types . . . the best of three well-known makes . . . designed and manufactured by pioneer bearing specialists with more than thirty-five years' manufacturing experience.

This is Leadership as far as the product itself is concerned.

But M-R-C offers more than a complete line of tested and proved bearings. It offers assistance in engineering these bearings into your designs.

For longest and most satisfactory performance, place the responsibility for bearing selection and application in the hands of M-R-C Engineers.

MARLIN-ROCKWELL CORPORATION

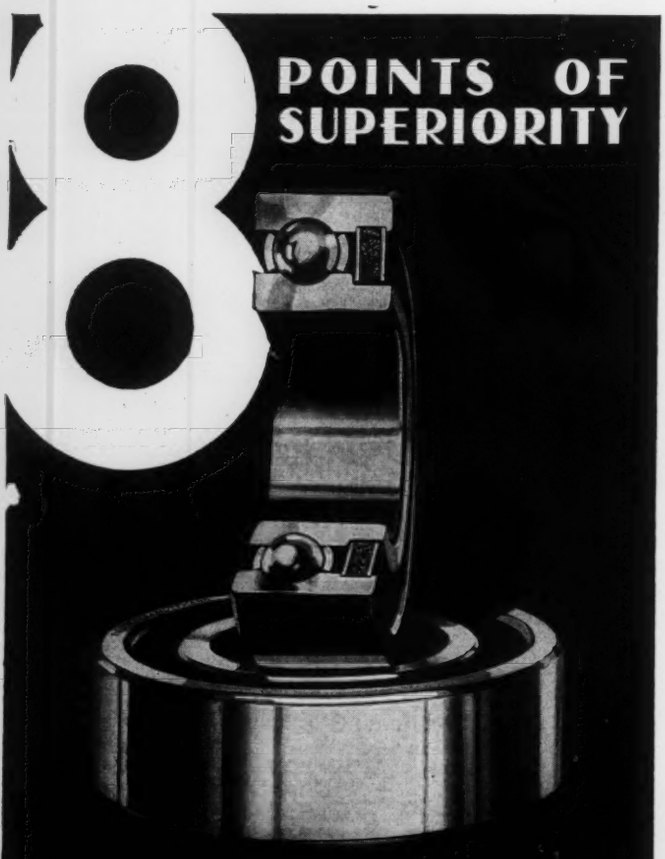
Executive Offices:

Jamestown, N. Y.

M-R-C Strom SRB GURNEY BALL BEARINGS

Manufacturers of

• GURNEY • SRB • STROM • BALL BEARINGS •



① Thick, closely-fitting felts, providing extra protection.

② Effective labyrinth, formed by felt seal and plates against recessed inner ring.

③ Seal removable in its entirety—for inspection, cleaning, or renewal of felt if needed.

④ Felt seal within confines of inner and outer rings and therefore not exposed to injury.

⑤ Wide, solid inner and outer rings, with maximum contact on shaft and housing, make inserts in housing unnecessary and militate against slippage, looseness, and escape of lubricant past outer ring.

⑥ Outer ring can be clamped on both faces.

⑦ A self-contained all-steel unit; construction assuring dimensional exactness and quiet running.

⑧ Grease capacity ample for long periods of service.

Write for the Catalog, describing this 7000 Series "GreaSeal" Bearing, together with the complementary line of adjusting springs, felts and washers.

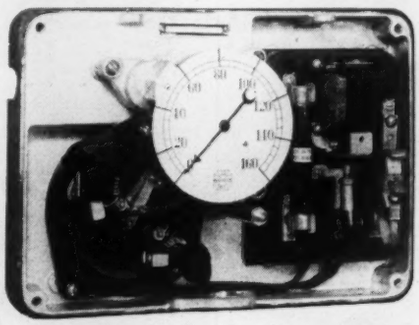
GREASEAL
FELT-PROTECTED
‹ PATENTED ›

NORMA-HOFFMANN BEARINGS CORPORATION, STAMFORD, CONN., U. S. A.

is available in stock types, with and without gear reduction ratios which are 27.67:1 and 48:1. Oilless bearings are employed. The motor provides 1/1000 horsepower, with full load speed 2300 revolutions per minute. Net weight is 1¼ pounds. The construction provides for easy mounting.

Pressure Governors Are Improved

AN IMPROVED line of pressure governors, designated as type CR2922, has been developed by General Electric Co., Schenectady, N. Y. Although these governors, shown herewith, are especially adapted for pumping station service, they can be used readily in industrial processes where it is desired to maintain a predetermined pressure. The scale of these new governors can be furnished to read water heads in feet instead of the usual pounds per square inch. Adjustments can be made between the limits of 20 to 80 per cent of the full scale rating. The maximum differential is 60 per cent and the minimum is 2 per cent of the full scale rating. Accuracy at a setting is 1 per cent of the full scale.



Predetermined pressures can be maintained by new governor

Timing Contactors Are Redesigned

TIMING contactors which will operate in any position without the need of leveling and which are unaffected by vibration have been introduced by Automatic Temperature Control Co. Inc., 34 East Logan street, Philadelphia. Power for the units, shown herewith, is obtained from a reversing synchronous motor and the contact arm moves alternately clockwise and counterclockwise within the time limit set, making a ten ampere 110-volt alternating current

MODERN MACHINERY CALLS FOR MODERN METALS

ALLOYS CONTAINING NICKEL...

HELP TO WING YOUR MESSAGE TO EVERY PART OF THE GLOBE

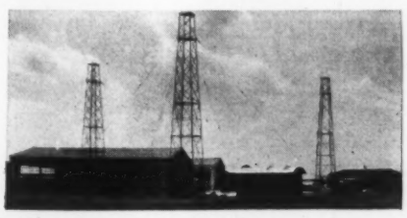
SEATED comfortably in your living room you turn the dial of your radio... And out of the Antarctic dusk comes the voice of Admiral Byrd. Close your eyes and he might be just across the room.

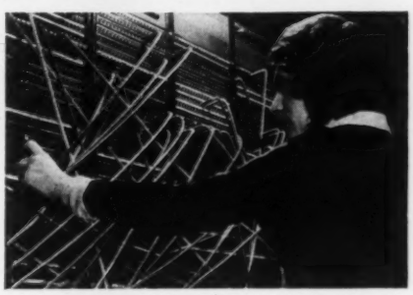
In your office the telephone rings. And with all the clarity of a local call, your Paris representative talks to you across the Atlantic.

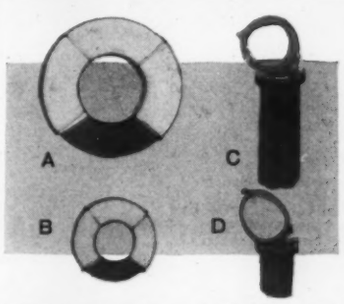
By telegraph... and by cable... messages flash to the farthest corners of the globe, dispatched at a speed and volume that a decade ago would have seemed fantastic.

And helping to work all these miracles of present day communication is a versatile group of modern metals... alloys containing Nickel.

Alloys containing Nickel speed up transmission by increasing the message-carrying capacity of the cable. They form the cores of radio audio transformers and important parts of the screen grid tube. They form the cores of telephonic and telegraphic relays, and important parts of receivers, earphones, transmitters. In fact, there are dozens of applications in the communication field where alloys containing Nickel are used.







PERMALLOY... A highly magnetic Iron-Nickel Alloy containing up to 80% Nickel. Widely used for electrical sheathing of submarine cable, radio transformers, telephone and telegraph relay parts... Pictures above show the saving in space effected by the use of Permalloy loading coils compared with powdered iron. *A*—powdered iron coil. *B*—Permalloy coil producing same loading effect. *C*—Case potting of 200 powdered iron coils. *D*—Case potting of 200 Permalloy loading coils.

Their use, however, is by no means confined to this field. Alloys containing Nickel are widely employed today in every industry where machines require metals of greater endurance and greater dependability.

When Nickel is correctly alloyed with other metals a wide range of improved properties is obtained—properties that assure increased resistance to the destructive forces of heat, stress, fatigue, erosion, corrosion, abrasion and wear.

Hence when equipment is thoroughly modern you are certain to find Nickel Alloy Steels, Nickel Cast Irons, Nickel Bronzes, Stainless Steels, etc., serving a wide range of purposes.

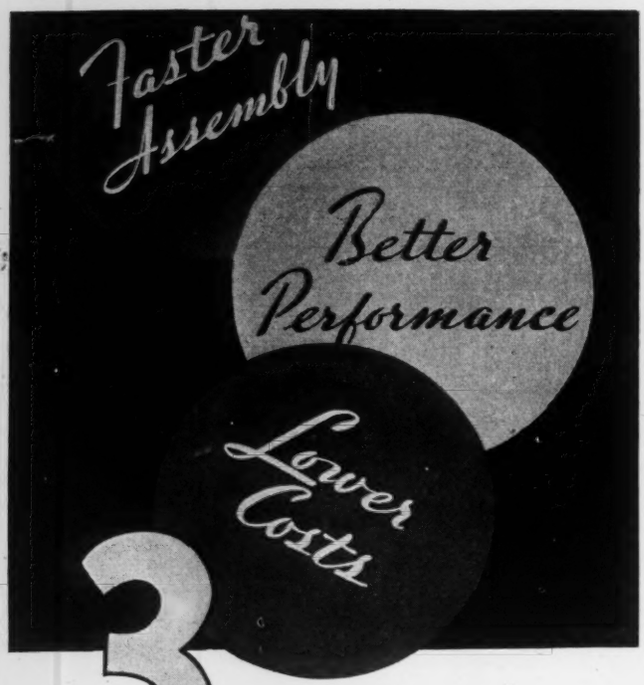
Alloys containing Nickel are commercially available *in a variety of compositions* in all important metal consuming centers. If you are planning to build new equipment or modernize the old, our engineers will be glad to advise you concerning the most suitable applications.

THE INTERNATIONAL NICKEL COMPANY, INC.

Miners, refiners and rollers of Nickel. Sole producers of Monel Metal.

67 Wall Street New York, N. Y.

SHAKEPROOF



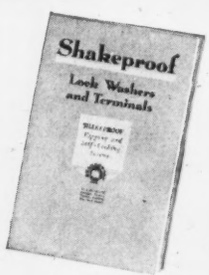
BIG REASONS

why it pays to build the

SHAKEPROOF LOCKING PRINCIPLE

into your standard parts

IF YOU are anxious to improve the performance of your product and also cut your production costs, you should talk with a Shakeproof Engineer. He will show you how you can build the Shakeproof Locking Principle into many of your standard parts and thus provide perfect protection against vibration and, at the same time, eliminate the need for purchasing extra lock washers. By this method you will have the twisted teeth of Shakeproof biting into both nut and work surfaces and, regardless of the amount of vibration, the part so protected will never budge. Send for further information and hear what this method has meant to other leading manufacturers. Write us today!



Send today for your free copy of this complete Shakeproof Catalog. Explains thoroughly the many advantages that Shakeproof offers—also shows new patented Shakeproof products.

SHAKEPROOF
Lock Washer Company

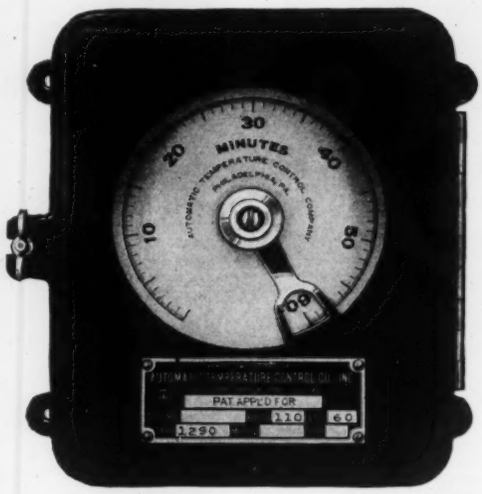
{Division of Illinois Tool Works}

2551 N. Keeler Ave. Chicago, Ill.

U. S. Pat. 1,112,564—1,901,122—1,915,054—1,982,387 Other Pat. Pending—Foreign Pat.

load circuit for an adjustable time at either extreme of its travel. Elapsed time can be set to a split scale division for any range desired within the dial selected.

Timing contactors of this new design also are available to be actuated from a momentary con-



Timing contactors are unaffected by vibration or position

tact switch; these units run for the time cycle for which they have been adjusted and stop until the starting switch is again energized. The cycle stop contactors make and hold their load circuit at the expiration of the time set, or they may be supplied to make the load circuit at the start of the time cycle and break it when the time set has elapsed.

Electrode Designed for Cast Iron

DESIGNED for welding cast iron, the Ferroweld electrode, developed by Lincoln Electric Co., Cleveland, has a steel core surrounded by a heavy flux coating which protects the arc from gases injurious to the weld which are present in the atmosphere. The electrode can be used with unusually low heat, thus reducing the possibility of cracking. It is manufactured in only one size, ⅛-inch, and is used with approximately 80 amperes of current.

Announces Improved Capacitor Motors

SINGLE phase capacitor motors in a new line have been brought out by Marble-Card Electric Co., Gladstone, Mich. These motors, shown herewith, are similar in construction to a two-phase squirrel cage motor with a condenser con-

PUT THE DESIGNING ENGINEER IN YOUR PROSPECT FILE

•

• • *Among others, these are the machine parts and materials specified by Designing Engineers who read* **MACHINE DESIGN:**

Alloys, Bearings, Bolts, Castings, Clutches, Composition Products, Controllers, Drives, Finishes, Flexible Shafts, Forgings, Gears and Speed Reducers, Special Lock Washers, Nuts and Screws, Lubrication Devices, Motors, Metals, Packing, Pulleys, Pumps, Springs, Pressed Metal Parts, Tubing, Valves and Fittings, Welded Parts, Drafting Room Equipment.

HE IS THE MAN who specifies the machine parts and materials purchased and used by the country's 6200 machinery manufacturing plants.

It is the designing engineer who decides which metal, which bearing and which type drive will be used in the construction of the machines he designs.

He is your prospect and you can reach him regularly and effectively with your advertising in MACHINE DESIGN, which is edited and published solely for him . . . It is his paper . . . the first publication devoted exclusively to machine design.

It is a publication in keeping with its high type of reader and an excellent example of the printer's art. Advertising visibility is high because editorial and advertising run side by side, thus assuring informative advertising a most receptive audience.

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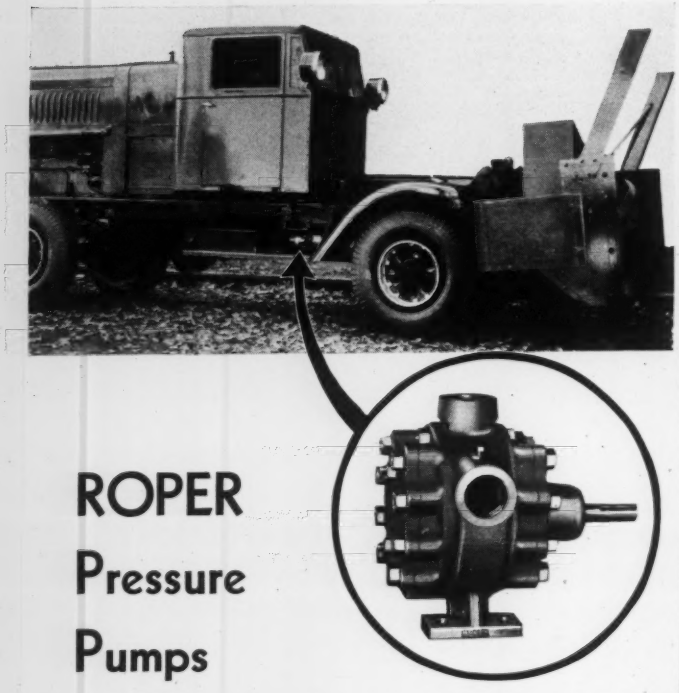
MACHINE DESIGN

Another New Roper

Pressure Pump Installation



ROPER Pressure Pumps for Hydraulic Application

S N O G O . . . famed for its efficiency in removing snow from streets and highways . . . a product of the Klauer Manufacturing Company, Dubuque, Iowa . . . is now equipped with a Roper Hydraulic Pump for lifting and direction control.

The manufacturers of "SNOGO" state that the Roper Pump, running at 1,000 RPMs gives a plow lift of 12″ with a speed of about seven seconds.

There is a complete line of Roper Hydraulic Pumps for actuating machine tools, road machinery, elevators, lifts, stokers, etc. Wide variety of sizes, capacities, and mounting designs. Types for either lubricating or non-lubricating liquids. Pressures up to 1,000 lbs.

Geo. D. ROPER Corp. — Rockford, Ill.

ROPER

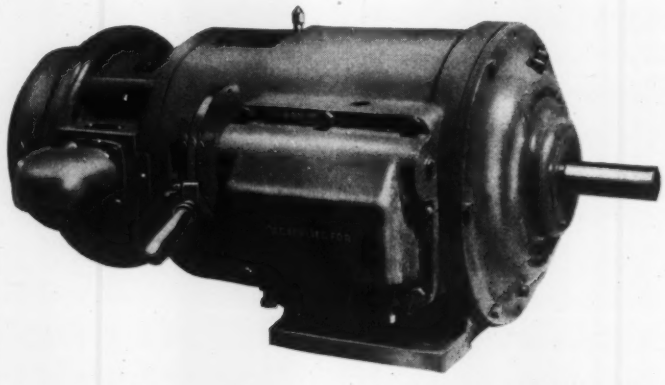
TRADE MARK

nected across one phase for starting, the condenser being automatically cut out of the circuit by a simple contactor when the motor comes up to speed. The condenser and contactor are mounted in a sheet metal box. The motors have high starting torque and good power factor.

Condenser is cut out automatically when the motor comes up to speed in improved capacitor motors

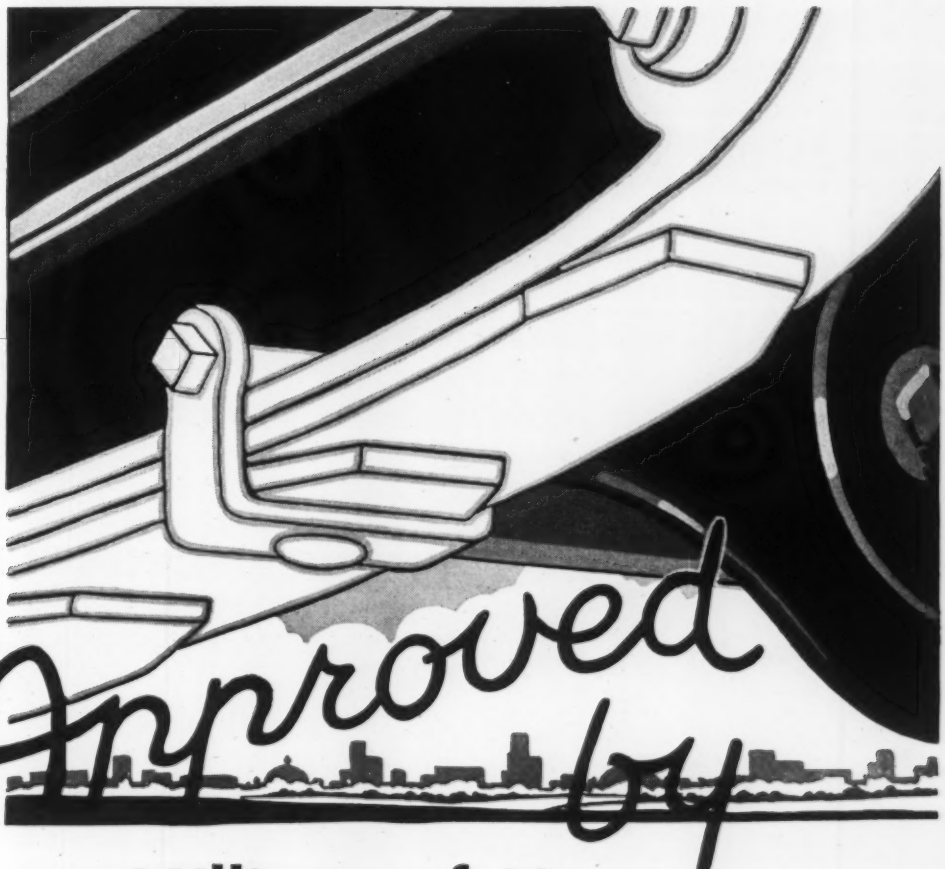
Reducers Provide Four Speeds

FOUR speeds are available from the output shaft of the new multi-speed reducers developed by Davis & Thompson Co., Milwaukee. These drives, shown herewith, combine a gear reducer, a high constant speed motor and gear changing mechanism into a single unit to give speed variation and speed reduction with one part.



A gear reducer, a high constant speed motor and a gear changing mechanism are included in one unit

The reduction in speed is obtained through planetary gears, gears of composition material being used for quietness. A shifting lever brings



Millions of Users Illinois Chrome Vanadium Spring Steel

Here is a steel in which controlled production has assured a quality which has been approved by literally millions of users. Its chromium content provides hardness and strength and its vanadium content provides toughness and resiliency. The metallurgy of this steel is so controlled by the Illinois Steel Company as to assure uniformity in hardness after heat treatment.

For all leaf springs—and particularly for those subjected to hard service—it is impossible to find a more reliable steel than Illinois' Chrome Vanadium.

Write today for information—or for the consultation of our representative—in determining the applicability of Illinois Spring Steel to your requirements.

Illinois Steel Company
SUBSIDIARY OF UNITED STATES STEEL CORPORATION
208 SOUTH LA SALLE ST. CHICAGO · ILLINOIS

ILLINOIS *alloy* STEEL
ALWAYS DEPENDABLE

Ever Need *tiny* Set Screws?

Here is a BRISTO Screw not much larger than a pencil point... one of 7 standard sizes... all under ¼" diameter

Unique BRISTO Socket is the only practical one for Small sizes— and it's superior for large sizes

SUPERIOR for any size set screw, the patented dovetailed BRISTO design is the only practical socket for very small screws. It means sure, trouble-free action, even for the tiniest of the seven standard extra small BRISTO set screws.

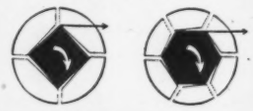
There is never any danger of rounding out or splitting the BRISTO socket. All the force needed for a tight set and positive hold may be applied. Also work is speeded up, for the BRISTO Wrench slips into the flutes of the socket easily, without fumbling . . . then applies force in the most effective manner. Add to those advantages the finer appearance of these screws, and the fact that the unique design discourages tampering by unauthorized persons—even though a file or bar can be used in an emergency instead of the BRISTO Wrench.

You can see how BRISTO Set Screws — and BRISTO Cap Screws which have the same advantages—will aid in your work, and improve your product. *Yet they cost no more than ordinary screws.* It will pay to write for full information and *free samples.*

WHY THEY'RE BETTER

Compare direct turning pressure of BRISTOS with—below,

sidewall pressure of other designs.



THE BRISTOL COMPANY, WATERBURY, CONN.

Branch Offices: Akron, Birmingham, Boston, Chicago, Denver, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis, San Francisco

TRADE MARK

BRISTO

REG. U.S. PAT. OFF.

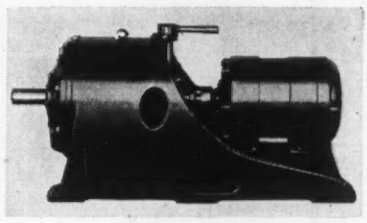
Hollow Safety **SET SCREWS** *Socket Head* **CAP SCREWS**

the proper reduction into use. The reducer is driven by a standard NEMA frame motor, the shaft of which is not turned down or changed in any way.

These multi-speed reducers can be secured in sizes from ¾ to 10 horsepower. Practically any combination of ratios from 3:1 to 7:1 can be furnished. This in conjunction with other reductions will give a wide speed range and also total reductions up to 600:1 or higher if the application demands it.

Reducer Incorporates Speed Changes

DIFFERING from the usual changeable speed design in that it incorporates both the speed range and the speed reduction in a single housing, the new two-speed Motoreducer offered by Falk Corp., Milwaukee, is furnished ready for immediate attachment to all NEMA dimensioned motors. The housing of a standard unit is used, thus affording complete interchangability of mounting of either the single speed or two speed type. With the units in the line a fast speed of from 155 to 583 is possible while the slow speeds range from 36 to 247.



Speed changing means is incoprorated as integral part of motorized reducer

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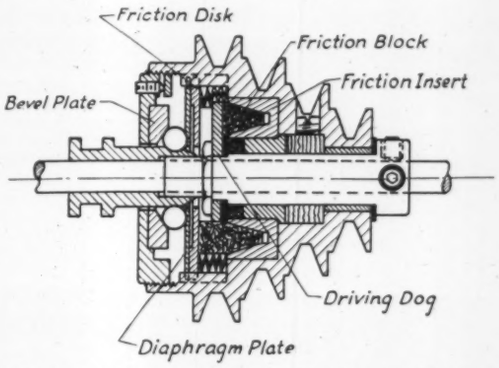
Clutch Employs Die Castings

A DRY friction clutch, simple and sturdy both in design and action, has been brought out by Walker-Turner Co., Plainfield, N. J. This clutch, shown herewith, is designed primarily to carry light loads at high or low speeds. It may be applied to ¾, ⅝ or ½-inch shafting without the necessity of doing any machine work on the shafting. The clutch casing as shown embodies a four-step cone pulley for V-belts. For transmissions involving flat belts, chains or gears different casings may be substituted.

The casing is a zinc die casting into which a cast iron friction element having a V-shaped groove has been inserted. This element receives the other clutch element which is annular and also V-shaped. Composition of the annular element is similar to that used in molded brake

linings. The molded element has three lugs on the end opposite to the friction surface. Into these lugs is permanently meshed a steel dog



Steel dog is permanently in mesh in light duty clutch design

which is secured to a steel sleeve that in turn is attached to the shafting with hollow head setscrews or Woodruff key.

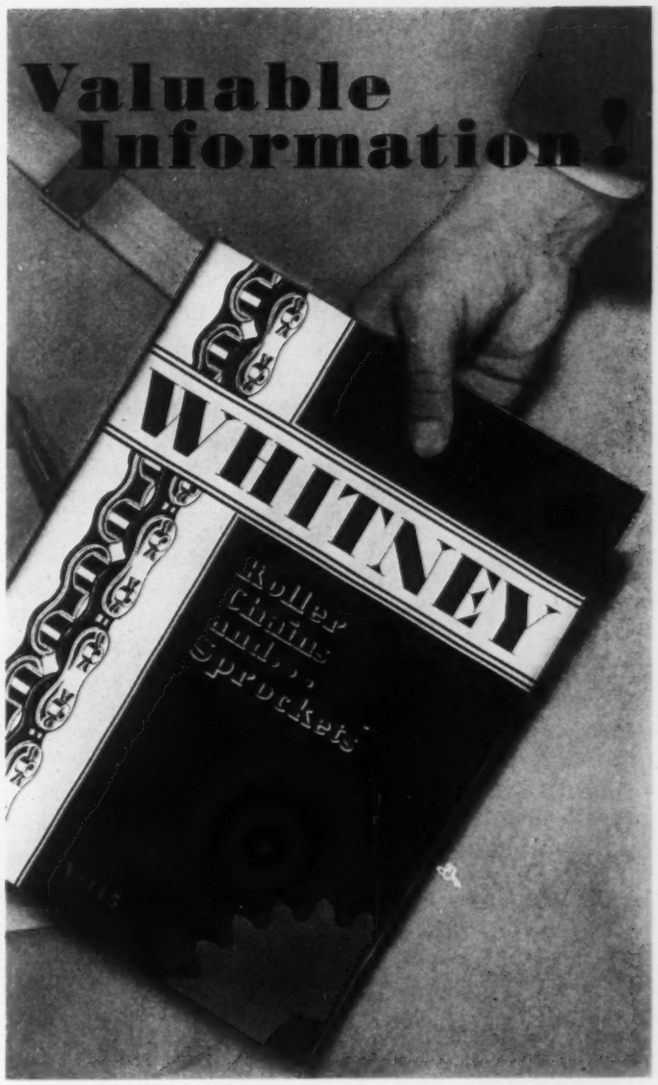
Develops Dust-Tight Capacitors

FOR use in dusty atmospheres, General Electric Co., Schenectady, N. Y., has developed a totally enclosed nonflammable capacitor. The dust-tight unit, shown herewith, is intended not only for machinery operating in plants such as grain mills where dust is prevalent, but also for

Capacitor is hermetically sealed, connections being brought out through bushings into a dust-tight box

textile machinery used where lint might prove troublesome. This unit is treated and filled with Pyranol which is nonflammable and which has extraordinary insulating and dielectric properties. In addition, this material has made possible a capacitor of smaller size and weight.

The capacitor dielectric itself is hermatically sealed, and connections are brought out through bushings into a dust-tight box which surmounts



Throughout industry, Whitney Roller Chain Drives fill a definite need for a mechanical power transmission medium of high efficiency and great dependability. Their outstanding performance has helped to solve many difficult power drive problems.

The new Whitney Roller Chain and Sprocket Catalog V-115 has much valuable information for engineers, production men and those who specify or purchase power transmission equipment. It will gladly be sent on receipt of the coupon shown.

Boston Cleveland New York San Francisco
Chicago Detroit Philadelphia Syracuse

THE WHITNEY MFG. CO., HARTFORD, CONN.

THE WHITNEY MFG. CO., Hartford, Conn.

Gentlemen:

Kindly send a copy of your new V-115 Roller Chain and Sprocket Catalog to —

Name.....

Address.....

Company.....

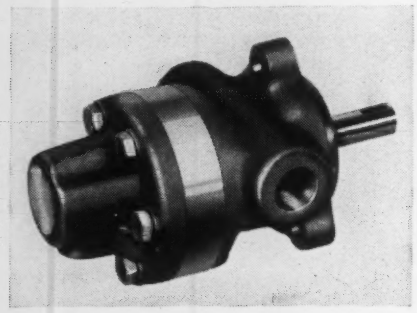
Title.....

V-115-6

the unit. The box is provided with conduit holes, each fitted with a dust cap, and contains standard N. E. C. indicating fuses.

Improved Pump Has Few Parts

A SMALL capacity, high pressure, rotary pump with positive displacement has just been introduced by Sundstrand Machine Tool Co., Rockford, Ill. This pump, an addition to the company's line of Rota-Roll pumps, is designed for pumping water at high pressures as well as oil and other fluids. The pumping members comprise a rotor and roller which revolve with each other in a manner similar to a single roller rolling with the outer race of a roller bearing.



Pump members comprise a rotor and a roller which revolve with each other

The pump, shown herewith, has few parts and is small and compact with a hub and flange on the body for flange mounting or for attaching a foot for foot mounting. Other features are quiet operation with smooth uniform flow as well as high suction.

Markets Special Bronze Castings

ELESCO bronze castings are now being marketed by the bronze foundry division, Superheater Co., East Chicago, Ind. The company produces bronze castings, rough or finished, in three distinct classes of mixtures, namely standard bronzes, aluminum bronzes and supertensile manganese bronze. Standard bronzes are readily machinable and are furnished in cored or solid bars or castings made from the customer's pattern. Aluminum bronze machines readily in all but the harder grades, is highly acid resisting, is especially efficient for gears, worm wheels, pinions, etc., and is furnished in cored or solid bars for bushings or bearings. Supertensile manganese bronze has a tensile strength of over 115,000 pounds, is used largely where extreme strength is desired and where loads are especially heavy, it machines readily.

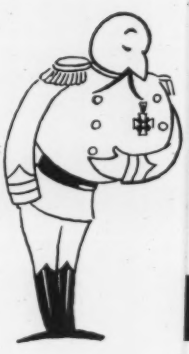
MORSE PRESENTS

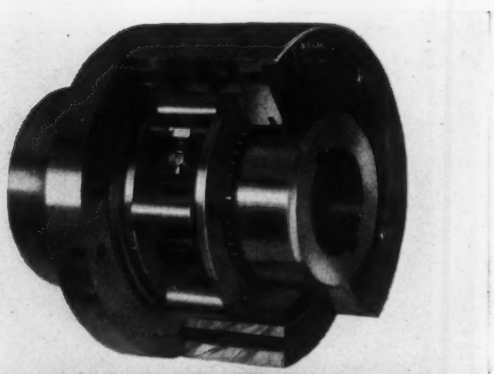
A POSITIVE-ACTION free-wheeling clutch for industrial installations, simple in design and construction. Nickel alloy steels hardened and ground to close limits insure long life and constant service.

Suitable for high speeds, the Kelpo runs cool, is perfectly balanced, and is not affected by centrifugal force. It is the only free-wheeling clutch which compensates for wear.

Kelpo Clutches can be used wherever wheels turn—many special machine applications. Interlocking between two power sources is unnecessary when the Kelpo Clutch is used.

Kelpo Clutches are now manufactured by the Morse Chain Co.—your assurance of quality and proper engineering application. Write for more information.





MORSE-KELPO FREE WHEELING CLUTCH

MORSE

ITHACA, NEW YORK

Manufacturers of Morse Silent Chains · Roller Chains · Standard Couplings · Flexible Couplings · Pullmore Clutches

SCANNING THE FIELD FOR IDEAS

(*Concluded from Page* 19)

ly nothing was done on steam planes for some years but the question again was discussed about 1925 and the potentialities estimated. However, it remained for Besler brothers to bring the development to a practical point. Several years of laboratory work preceded the actual flight, during which time several engines and steam generators were developed. The engine finally constructed was a two-cylinder double-acting, compound, 90 degree, Vee, with cross-heads and auxiliary drive. Engine alone weighed 180 pounds. The steam generator was of the continuous coil type fired by diesel or furnace oil ignited electrically. Boiler was automatically controlled, total temperature of the steam being maintained at 750 degrees Fahr. by a normalizing device which injects water into the superheated steam in the main line, sufficient in quantity to maintain the desired temperature. Feed pump was a steam driven, vertical type. A primary and secondary feed water heater were included, the latter located below the bottom of the fuselage approximately under the pilot's seat.

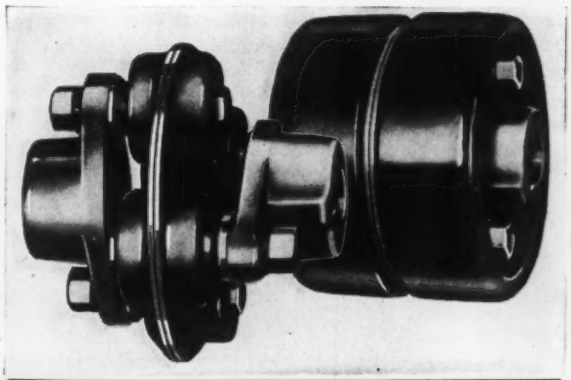
Atmospheric condensers were built, the one fitted below the fuselage being made up from the core of a steam automobile condenser. To supplement this, a more efficient one was made from an OX-5 radiator and mounted on top of the fuselage. The two units were connected by aluminum pipes extending down each side of the fuselage.

First flights were short but impressive. To fire the boiler an external battery was used because of the low capacity of the battery fitted to the airplane. From the time the fire was started until the engine was run up not more than five minutes had elapsed. The takeoff was normal in every respect except that the absence of noise was most noticeable.

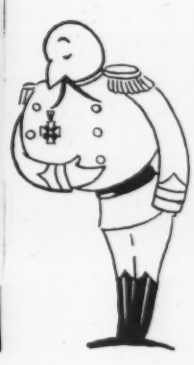
Although the power plant installed in the plane obviously was makeshift with auxiliaries making up too large a percentage of the weight, the innovation proves a point; namely the feasibility of steam-powered airplanes. Investigation showed very conclusively that many of the deficiencies apparent in the steam power plant when considered for normal low altitudes flight disappear when very high altitudes are considered, according to A. F. Bonnalie of the Boeing school. He further contends that the weight of the plant can be brought down materially when actual delivered horsepower at an altitude is considered as the criteria.

MORSE PRESENTS

A Companion to the Standard Chain Coupling



THE MORFLEX COUPLING



THIS new Morse Flexible Coupling, a fitting companion to the Morse Standard Coupling, is both simple in design and rugged in construction. It is noiseless in operation, and utilizes a new, especially developed rubber as the flexing medium.

Accurate tests of the Morflex Coupling demonstrate a maximum of flexibility without power loss. Shocks and uneven impulses are absorbed, and sudden reversal can take place without damage.

The Morflex Coupling needs no lubrication. It needs no protection from atmospheric conditions—water, oil, dirt or grit do not interfere with its smooth operation.

Made by Morse Chain Co., which means quality and precision products. Write for further information.

CHAIN CO.

DETROIT, MICHIGAN

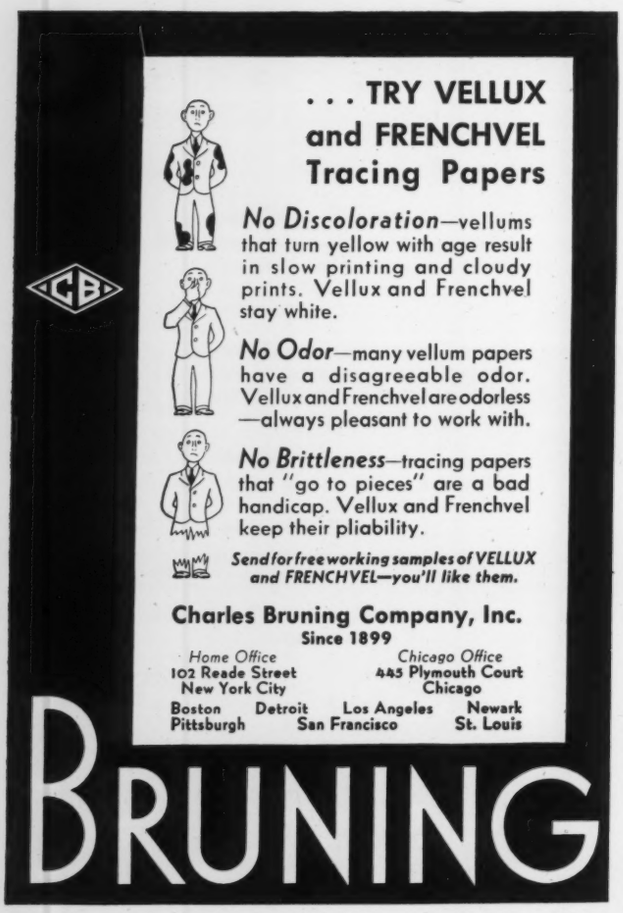
Morse Chain Co., Limited, Letchworth, Herts, England · Branches in Principal Cities · Division of Borg-Warner Corporation

When the Specifications Call for Pumps

Specify VIKING

The Viking Rotary Pump, with its world famous, patented "Two Moving Parts" Principle . . . offers an almost endless variety of applications in practically all types of industry involving the handling of grit-free liquids. The Viking line includes, All-Purpose, Sanitary, Underwriter's Labeled, Fuel Oil, Coolant, Steam-Jacketed for handling viscous liquids, Gasoline, High Pressure on Hydraulic Oil and Idler Drive type High Pressure pumps. All types of drives and mounts. Capacities of 1/5 to 1,050 G.P.M. . . . at relatively slow speeds. Economical to buy . . . easy to install . . . long lived. It will pay you to investigate the Viking line. Write today for further information and prices.

Viking Pump Company
Cedar Falls, Iowa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No Discoloration—vellums that turn yellow with age result in slow printing and cloudy prints. Vellux and Frenchvel stay white.
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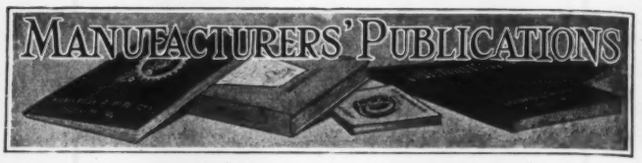


ALLOYS (IRON)—Super Manga Iron, a nickel-chromium cast iron, is presented in a new folder of Robins Conveying Belt Co., Passaic, N. J. The folder includes the characteristics of the material now being offered.

BEARINGS—New Departure Mfg. Co., Bristol, Conn., has prepared literature on its new precision ball bearings, flanged for use on spindles, which have the shoulders on the outer races of the bearings instead of in the bearing housings.

BEARINGS—Kingsbury Machine Works, Inc., Philadelphia, has published bulletin G-1 of especial interest to designers of marine and heavy industrial machinery on applications of new standard thrust bearings and journal bearing mountings for horizontal shafts ranging from 2¾ to 23¼ inches in diameter.

BRONZE—Shenango-Penn Mold Co., Dover, O., is distributing bulletin No. 133 on its line of centrifugally cast bronzes and other alloys. The bulletin gives the direct and indirect advantages of use of the castings, range of sizes, applications, machining facilities and products of the company.

CAPACITORS—Ideal Electric & Mfg. Co., Mansfield, O., has prepared a 16-page booklet on capacitors for power factor correction which includes tables for determining the right size capacitor required for correction of a low power factor condition.

CAST PARTS—Elesco Bronze castings, produced by bronze foundry division, Superheater Co., East Chicago, Ind., are described in a new booklet of the company which gives the different grades, typical uses, specifications, stock parts and similar information.

CONTROLS (ELECTRICAL) — Cutler-Hammer Inc., Milwaukee, is distributing new catalog insert sheets for its catalog which includes new price sheets and data on starters, controllers, speed regulators, relays, overload switches, enclosed pressure switches, machine limit devices, resistors, rheostats, and similar parts which can be included in machines.

DRIVES—Motoreducers manufactured by Falk Corp., Milwaukee, are presented in bulletin No. 270 which includes descriptions of several new additions to the line not heretofore presented. The new units are an all-motor type which allows the user the utmost freedom in his choice of motor, a new single reduction type and a two-speed motoreducer which combines both the speed range,

and a speed reduction in a single housing.

FASTENINGS—General information on the subject of screws, bolts, nuts and allied products is included in the new 1934 catalog of Pheoll Mfg. Co., Chicago. Reference tables giving complete information on American national standard screw threads and tolerances are included as well as other data required in engineering departments.

FINISHES—Corrosion resistance, wear and abrasion resistance, and insulation against electricity, heat, sound or vibration through the rubber coating of metallic parts feature the discussion in a bulletin recently issued by B. F. Goodrich Rubber Co., Akron, O.

FINISHES—The application of No-Ox-Id, a chemically compounded rust preventative, in the railroad field is presented in a well prepared booklet of Dearborn Chemical Co., Chicago. The booklet describes typical applications, and gives the protective powers of the coating.

FLEXIBLE SHAFTS—These drive units and equipment for use with them are illustrated and described in catalog No. 26 of N. A. Strand & Co., Chicago.

INSTRUMENTS—Potentiometers, their advantages, design and application are covered in a recent folder of Brown Instrument Co., Philadelphia. The folder includes photographs of principal parts of the instrument.

INSTRUMENTS—Recording, controlling and indicating instruments are completely reviewed in bulletin No. 185 of Foxboro Co., Foxboro, Mass. The booklet gives detailed information on the operation of the instruments and outlines their application.

MOTORS—The design, performance characteristics, applications and advantages of motors manufactured by Marble-Card Electric Co., Gladstone, Mich., are discussed in catalog No. 33 of the company. The publication also includes information on generators, motor-generator sets and rotary convertors.

PUMPS—Type T regenerative turbine pumps, designed to handle comparatively small quantities at high pressures, are described in bulletin 260-B11 of Roots-Connersville-Wilbraham, Connersville, Ind. The bulletin includes a general discussion of the applications, operating characteristics, design features, etc.

STEEL—Union Drawn Steel Co., Massillon, O., has prepared a folder giving the location of its mills, district sales offices and distributors' warehouses, and a listing of the company's steel products.

WELDED PARTS AND EQUIPMENT—Elements of welded wheel design are included in application sheet No. 36, Series 2, of Lincoln Electric Co., Cleveland. Both a description and drawings of wheels are presented in the leaflet.

FOR LOW SPEED
Use G-E
Fractional-Horsepower Gear-Motors

SPEED

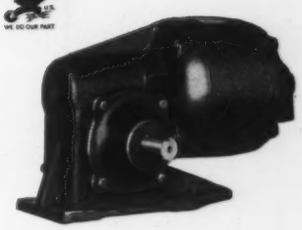
Concentric-shaft type — 500 rpm. and below

Right-angle-shaft type — 200 rpm. and below

NRA WE DO OUR PART

HORSEPOWER

Single-phase, Polyphase, Direct-current } 1/6 to 3/4 hp.



Compact Low-speed Drives Ready for Direct Connection to your Machines

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Deliver as low as 11 Rpm.

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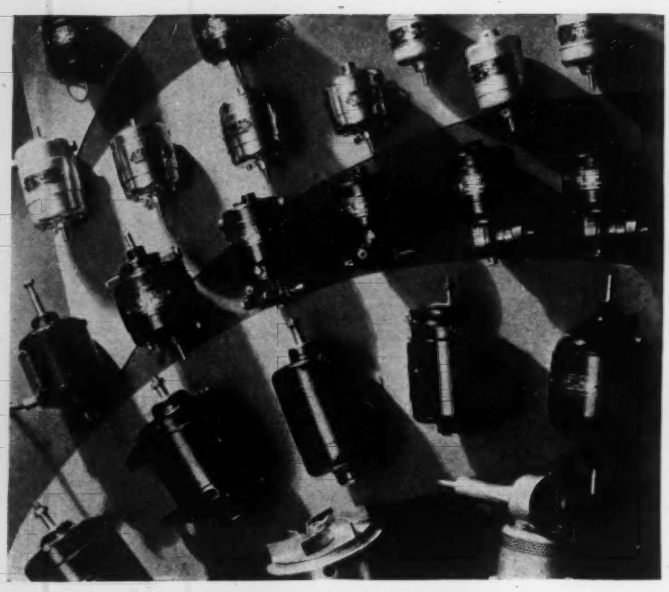

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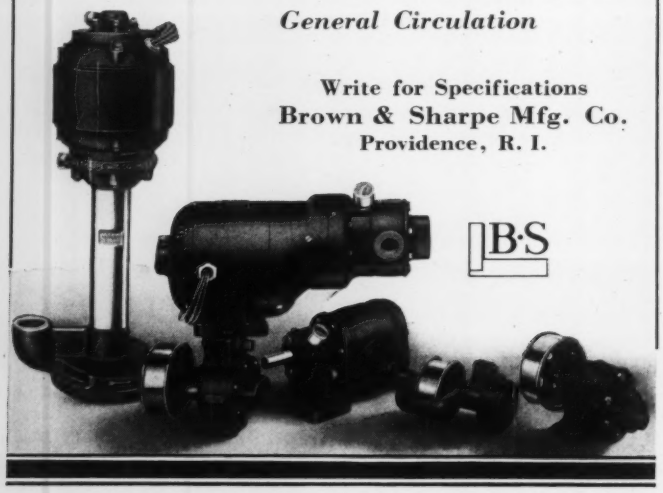

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Business and Sales Briefs

CHARLES F. NORTON who recently became associated with Louis Allis Co., Milwaukee, has been appointed general sales director of the company. Mr. Norton was formerly vice president and general manager of Howell Electric Motors Co.

* * *

Joseph T. Ryerson & Son Inc. has purchased the stock and goodwill of Bacon & Co., iron and steel company of Boston.

* * *

Headquarters of the American Society for Testing Materials has been moved to the Atlantic building, 260 South Broad street, Philadelphia.

* * *

Cleve W. Ritz has been appointed manager of sales for Columbia Steel & Shafting Co. in the Ohio district with offices located in the Ward building, 1210 East Fifty-fifth street, Cleveland.

* * *

Dr. E. C. Gilbert, former general manager of Chapman Valve Co., has been made general manager of Perkins Machine & Gear Co., West Springfield, Mass., to succeed Frederick H. Rice, who remains with the company as assistant treasurer.

* * *

Empire Sheet & Tin Plate Co., Mansfield, O., has appointed Taubensee & Richards, 400 West Madison street, Chicago, as district sales representatitves in the Chicago territory. J. M. Watson Jr. has been appointed district sales representative of the Empire company in Youngstown, O.

* * *

Bristol Co., Waterbury, Conn., has announced that in order to include sales, service and manufacturing, a separate company, Bristol Co. of Canada, Ltd., has been formed. Factory and general headquarters will be located at 64 Princess street, Toronto, Ont. J. S. Mayberry has been appointed manager.

* * *

Theodore M. Gloeckner, who has been associated with the sales organization of Union Drawn Steel Co., Massillon, O., for more than 15 years, has been appointed district sales manager of the Philadelphia office of the company with offices at 2030 Fidelity-Philadelphia Trust building.

* * *

J. S. Hoffman is in charge of the recently established Cleveland office of Udylite Process Co., Detroit, located at 708 Keith building. C. L. Anger, who has been identified with the plating industry since his graduation from the University of Michigan in 1919, has joined the staff of the branch.

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